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Official Publication of the Proceedings of the American Association of Textile Chemists and Colorists

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American Dyestuff Reporter was founded in 1917 and the Textile Colorist and Converter (formerly Textile Colorist) was incorporated with it in January, 1949. Published every other Monday by the **HOWES PUBLISHING COMPANY, INC., 44 E. 23rd Street, New York 10, N. Y. C. R. Howes,** President; **Harry F. Crawford,** Executive Vice-President; **Norman A. Johnson, Myron D. Reeser,** Vice-Presidents; **Ernest J. Finan,** Treasurer; **C. Essenbreis,** Secretary.

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FEBRUARY 4, 1952
VOLUME 41 NUMBER 3

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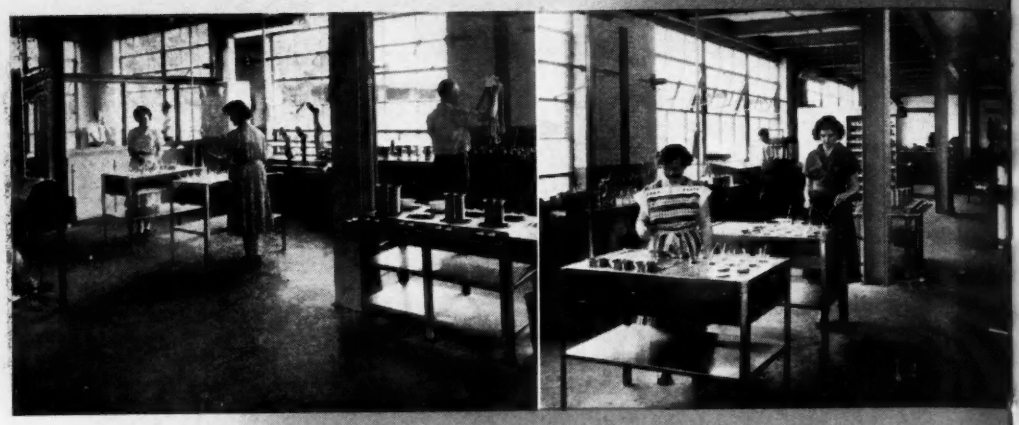

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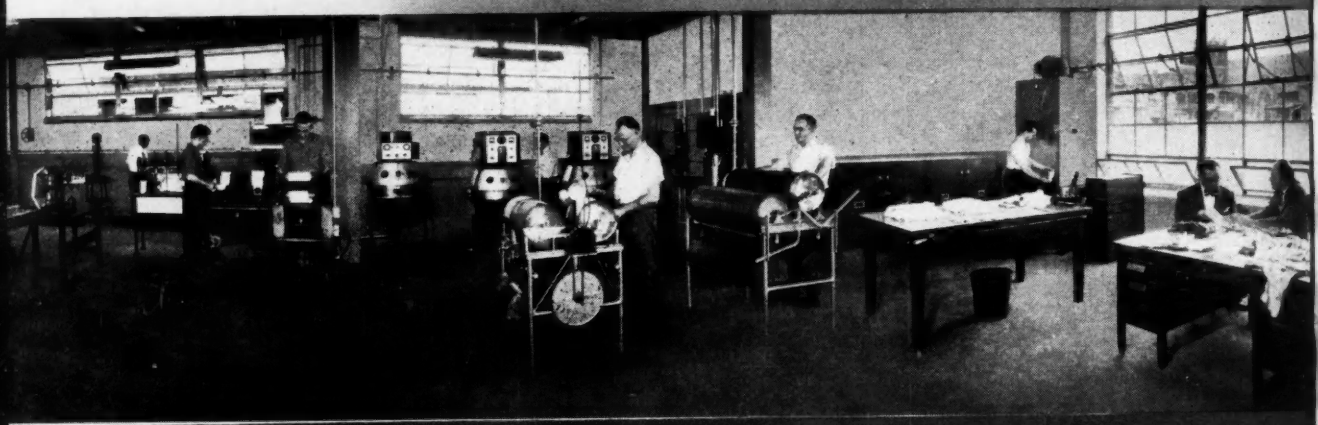

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AMERICAN
DYESTUFF REPORTER

VOLUME 41 FEBRUARY 4, 1952 NUMBER 3

THE TEXTILE RAINBOW*

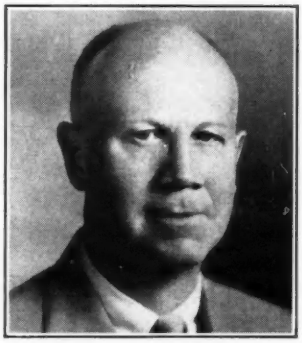
J H DILLON
Director, Textile Research Institute
Princeton, N J

INTRODUCTION

IT CERTAINLY was very kind of your program chairman to ask me to this pleasant function and to give a little talk. (At least, it has been nice for me.) I am always a bit surprised and a little shocked to find myself appearing before a chemical industry group. After all, I started my professional life as a physicist and retained that classification even after 15 years in the rubber industry. But after five years in the textile research field, perhaps I am still a physicist, perhaps not—at any rate, in physicists' or chemists' language, I definitely am in an "excited state". I am excited about the future of the chemical industry in the textile field and I think most of you should be excited also. If you aren't already excited, perhaps I should attempt to kick your electrons out into their less stable orbits—then let them fall where they will. The result should be sparks emerging from all our tails.

Now you may guess from the title of my talk that I intend to speak on textile dyeing and coloring. This would be a logical guess but, of course, a bad one; after all, why give a title at all unless it is misleading? What I do wish to talk about is that spectrum of textile problems which is the rainbow of opportunity for the chemical industry, particularly that part concerned with organic chemicals. But this is a "multi-cusp rainbow", and each time a branch of it approaches the horizon, there is a new pot of gold; it is the kind of gold that can be used to pay dividends to stockholders and doesn't require exhuming from the deep, dank earth of government military reservations.

You may surmise that I am planning to extol the virtues of the man-made fibers—perhaps I shall, but only incidentally. What I really wish to do is present the problems of the textile industry, both as regards natural and man-made fibers. As you probably know, my work with Textile Research Institute—TRI, for short—has to do with all the fibers: natural, regenerated, and synthetic. I strongly feel that there are as many opportunities for the chemical industry in the domain of the natural fibers—wool and cotton, in particular—as in that more glamorous area of new synthetic fibers. However, I don't particularly wish to recite the virtues of any fiber——natural, regenerated, or synthetic; my purpose is to point out the weaknesses of each, thus suggesting what remains to be done—this should be more stimulating, although it may seem a bit destructive in approach. At any rate, those who solve these problems stand to profit enormously, for they are working on that great "market of textiles" which combines the essential of human clothing with the nonessential but powerful vanities of decoration and style. But let us keep in mind that the final decision in regard to any fiber involves just three basic factors: availability, price, and superior properties for each application. Unless a new fiber or a modified natural fiber meets all three conditions, it has only a short-range future. By this I do not mean that a low quality fiber which is very cheap but available in great quantity cannot survive, nor do I infer that a high-quality fiber, priced rather high, is doomed. But the equation of fiber success is still $\int_0^t {}_1f(A,P,Q)dt$, where the function need not be linear in any of the variables—availability, price, and quality—but each must remain important in the series resulting from the integration from now to time, t_1. The limiting time, t_1, of course, depends on somebody's vision—perhaps yours. But suppose I now discuss the several principal natural fibers and the man-made fibers, each rather briefly and emphasizing problems rather than accomplishments.



John H Dillon

SILK

It is natural to start with silk. "Alas, poor Yorick, I knew him well." Silk is not quite dead, of course, for it still represents about 0.1 percent of our current textile consumption. Furthermore, the styling of luxury rayon and acetate fabrics still is based to some extent upon silk styles. Little Bombyx Mori never joined a labor union, but kept producing more and better silk and, had not international political and economic conditions interfered, would still be furnishing the primary luxury fiber. Little Bombyx was so clever that he inspired Robert Hooke, a theoretical physicist, to conceive the fiber extrusion process in 1664, and Hilaire de Chardonnet, a practical chemist, to try it out in 1881. Incidentally, Chardonnet's earliest experiments on nitrocellulose employed mulberry leaves as the base cellulosic material. So we had the early nitrocellulose "rayons" which resembled silk only in so far as they were spun as continuous filaments. They did have luster, of course, but not much else. But, let's not talk about rayon at this point—let's concentrate on Bombyx and his fate. He was able, first of all, to produce a fiber which, in overall physical

* Delivered before the January 9, 1952 meeting of the Synthetic Organic Chemical Manufacturers Association at the Hotel Commodore, New York, N Y.

and chemical properties, has never been successfully copied. Secondly, he spun a double fiber with sizing applied at or in the spinneret—try to do this some Sunday afternoon! But, in spite of his cleverness and his resistance to unionization, a world politico-economic situation got the better of him, plus scientific research. He will blissfully spin his cocoon ad infinitum, but in limited quantities, unless the silk interests really put some money into research, and in a hurry. Incidentally, some really wonderful scientific work was done on silk just before the last war, particularly in Japan. Regenerated silk has been produced with some success, and Professor Masami Oku, working with Professor Eugene Pacsu at Princeton University (Professor Pacsu is also on the TRI staff), has done some remarkable things with silk this year. But the variables A (availabilty) and P (price) are still dominant. Even with much brilliant research, silk will have a long row to hoe —too bad, too, the chemist has never been able to copy it.

WOOL

Wool, like silk, is a protein fiber but is more complicated chemically in the variety of amino acid residues found in its amazing stress-responsive structure. Like silk, it has never been successfully copied by the chemist. Some of its physical properties have been induced in the synthetic fibers, but no synthetic fiber can yet be considered a complete substitute for wool. There have been reports of new fibers that are "woolier than wool", but one sometimes is tempted to consider these reports as "wooly stories". However, no wool grower should take undue comfort in the fact that emulation is the most sincere form of flattery. Wool is a fiber worth copying, but that very fact is an all-powerful stimulus to the synthetic fiber chemist and physicist who now know that it is unnecessary to reproduce the complicated chemical structure of wool in order to achieve some of its outstanding physical properties. In fact, there are several synthetic fibers that have mechanical properties close enough to those of wool so they can be blended with it in reasonable proportions to give quite satisfactory fabrics. In certain cases, some of the fabric properties are improved by blending. For examples, Dacron in a worsted suiting fabric imparts an amazing permanence of crease, and Dynel blankets can be laundered without shrinkage, are mothproof, and are about equal to wool in warmth. Blending nylon or Orlon with wool in knitting yarns greatly improves the abrasion resistance and reduces felting shrinkage of wool socks. But in almost every instance where the synthetic fibers have replaced wool, new difficulties have been introduced. These will be discussed later in connection with the various synthetics.

It is not the purpose of this paper to defend the position of any fiber or provide comfort for its proponents. In the light of numerous positive statements appearing in the press to the effect that wool is going the way of silk, however, it is well to point out certain important facts which contradict these lightly considered assertions. First of all, the international economic situation which was primarily responsible for the destruction of the silk market does not exist in the case of wool. Wool is produced by alert, well-informed growers of Australia, New Zealand, South Africa, and this country. Wool growing is today a highly developed industry and wool growers are conscious of the threats of competing fibers. Great technical advances have been made in wool production. For example, I have been given to understand that it is common practice for the Australian sheep grower to perform an operation on the vaginas of ewes which greatly reduces the effects of urine on the wool of the under parts. Tremendous strides have been made also to increase quantity and quality of wool production by variation of the mineral contents of the sheep's diet. Contrast this with the situation in sericulture when silk faded from the scene. The typical raw silk producer was a Japanese family. A considerable fraction of each year saw this family give up its home in favor of the silkworm so that little Bombyx Mori could peacefully gobble his way through a lot of mulberry leaves and spin his cocoons. By this act of sacrifice, and by dint of loving care of little Bombyx, the sericultural family just managed to keep alive. It is true that some rather remarkable advances were made, but they were primarily in the operations following the production of the cocoon, reeling, for example. But the initial operation ending in the cocoon still remained major in the cost of silk production, as it is today, and now it is more profitable for that Japanese family to do something else which doesn't entail the inconveniences of sericulture.

In addition to the foregoing distinction between the wool and silk situations, it must be recalled that some rather brilliant research was done which has been an effective factor in maintaining the utilization of wool. Very little of this early research was supported either by the wool growers or wool manufacturers. Fortunately, scientists such as J B Speakman at Leeds and Milton Harris of the Textile Foundation became interested in wool and carried out extensive fundamental research. From this basic fund of information have sprung many practical improvements in wool, for example, shrink resistance and mothproofing treatments. Later, organizations such as the Wool Industries Research Association and Textile Research Institute became active and now we find some splended wool research going on at the Western Regional Research Laboratory of the U S Department of Agriculture under Dr Harold Lundgren. During the last three years, Textile Research Institute has had the opportunity of carrying out an extensive program of wool research originally suggested and largely sponsored by The Wool Bureau, Inc, representing the American Wool Council, the International Wool Secretariat, and the National Wool Trades. Other important sponsors of this program are the U S Department of Agriculture, the Office of Naval Research, and a group of progressive American wool manufacturers. Participating actively in the work is the Forstmann Woolen Company. They have carried out carefully controlled processing experiments in close cooperation wtih the TRI staff, who have made extensive studies of the changes taking place in wool fibers during processing. From these basic studies have come results which already suggest the possibility of major improvements in wool processing and wool fabric quality. In brief, then, the wool boys are "on the ball". The silk boys weren't until it was too late.

But, to maintain the central theme of this paper, we must take a look at the deficiencies of wool in order to define future progress in the field.

The problem of mothproofing has not been completely solved. However, there are a number of very effective commercial treatments. In general, it is considered that further advances in mothproofing are desirable but not particularly pressing even though some of the competing synthetic fibers offer no attraction whatsoever to the moth and carpet beetle.

Great progress in reduction of felting shrinkage has been made but there is room for improvement in existing processes, to provide less chance of damage to the fiber and harshening of the fabric.

Wool is not a strong fiber — 1.3 grams/denier at 70°F, 65% RH; 1.0 grams/denier wet. But for "wool applications", the dry tenacity is adequate. It is relatively good under wet conditions compared with any of the regenerated protein fibers. Possibly increases in strength can be achieved in wool but, on the basis of our present knowledge, large increases in tenacity would be accompanied by loss of resilience, one of the major virtues of wool. The same thinking applies to abrasion resistance, although this factor can be varied greatly by changes in yarn and fabric structures. This is still a fruitful field of research but it must be recog-

nized that blends of wool with certain synthetic fibers attain great abrasion-resistant qualities. Perhaps this is a direction which "wool research" should take; it might result in increased utilization of wool in products where wool alone is unacceptable abrasion-wise.

The moisture absorption, swelling and dyeing characteristics of wool seem to be extremely good. However, further research on these properties is definitely justified in that it may give further basic information on the chemical nature of keratin which may pay off in other areas of application.

Wool is a really remarkable material from the standpoint of crease resistance, providing it doesn't get too wet. Perhaps improvements can be made in crease resistance without undue impairment of its good properties—moisture absorption, resilience, fabric handle, etc.

The processing of wool is, of course, a complicated series of operations still carried on by largely traditional methods, although there have been some definite advances in machinery and some constructive chemical developments. For example, a recently developed material, β-propiolactone, has very interesting effects on felting and the mechanical properties of wool. In the course of the TRI Wool Project studies, we have found the chemical structure of wool to be remarkably uniform, regardless of origin and diameter. So also are its mechanical properties when properly calculated on the unit cross-section basis. Thus, while wool varies greatly in diameter and morphology, it is a very uniform chemical material, susceptible to the efforts of the chemist to improve its processing and properties. It is our hope that our experiments will point out more and more problems in wool processing for attack by applied chemists, physicists and engineers.

COTTON

Cotton remains undisputed king of the textile fibers, still accounting for about 70% of our consumption. There have been incursions into the kingdom and some important provinces have been ceded to other fibers, notably tire cord to viscose rayon, and part of bagging to paper. But these markets were lost before cotton research really got rolling and there has been about as great an increase in total poundage of cotton consumed during the past 20 years as has been the case for viscose rayon; the latter, of course, shows a much larger percentage increase. As with silk and wool, no synthetic cotton has ever been produced because high molecular weight and complicated "wavy corkscrew" morphology are characteristics which seem to defy reproduction. It is the only important fiber which is stronger wet than dry, and is particularly suitable for undergarments, shirtings, sheetings, and other fabrics in which wet strength, high moisture sorption, and rugged launderability are required.

Cotton is inherently a strong inextensible fiber, and some people feel that its lack of resilience is one of its greatest weaknesses. This is perhaps true in regard to that type of resilience which manifests itself in resistance to wrinkling. Considerable progress has been made in improving wrinkle-resistance by various chemical treatments, most of them involving resins and possible cross-linking reactions. Nevertheless, there is still great room for improvement in wrinkle-resistance treatments, particularly in the direction of reduction of harshness and increase of tear-resistance of treated cotton fabrics.

Attempts are being made to induce in cotton the long-range resilience of the wool fiber by swelling the structure and introducing bulky side groups into the network. From a purely scientific standpoint, it is quite possible that some success will be achieved in these experiments. However, results thus far indicate that it will be necessary to sacrifice crystallinity, one of cotton's basic virtues, in order to achieve long-range extensibility of the cotton fiber, and it is not at all certain that this extensibility will be of the reversible variety, i e, the probability of a practicable increase of the long-range resilience of cotton by purely chemical measures is far from unity. However, there is a good chance of attaining a much higher "yarn resilience" in cotton by introducing a stable crimp; this will require a combined chemical and physical attack and constitutes a great opportunity for the chemical industry.

Cotton has many other shortcomings, of course, such as inflammability and susceptibility to microbiological attack, hydrolysis and oxidation. Much good work has already been done in reducing these difficulties but they certainly have not yet been eliminated. The variabilities of cotton from crop to crop, region to region, fiber to fiber, and within a single fiber are major problems for the biologist but require the close attention of chemists and physicists who must discover and define the significant properties as related to mill processing and fabric quality. This latter field of study constitutes a major assignment of Textile Research Institute, the results of which, we hope, may point the way to the development of better varieties of cotton and improvements in the utilization of existing varieties.

REGENERATED FIBERS

Viscose rayon, of course, is chief among the regenerated fibers, increasing from 3% of our textile consumption in 1930 to 20% in 1950. Staple viscose rayon appears to have a very bright future for it is reasonably priced and its quality is being improved almost continuously. Recently developed wrinkle-resist treatments that greatly reduce chlorine retention and odor are only a few of the strides which have placed it among the quality fibers. Yet, it has shortcomings that may be overcome, such as low long-range resilience and loss of strength with increasing moisture. As long as its price remains reasonable, there is cause to anticipate further great advances in its utilization.

The regenerated protein fibers have at times seemed disappointing, particularly from the standpoint of wet strength. There are already indications, however, that their wet strength can be improved. Meanwhile, they are finding interesting applications in blended yarns where they add an unusual "loft", and their lower wet strength is not a serious defect.

SYNTHETIC FIBERS

The balance of this discussion will be concerned with some of the problems introduced by the synthetic fibers. I shall include acetate rayon in this class, although it is a cellulose derivative with a regain of 6% under standard conditions, since its properties are similar to those of the synthetics in many respects. The present fashion in synthetic fibers appears to demand progressively lower regains from 3.8% for nylon down to 0.4% in the case of dynel. Only time and experience will tell us the true significance of moisture absorption in clothing; however, we already know that low regain can be both a blessing and a curse.

DYEING PROBLEMS——To develop even a cursory tabulation and analysis of the many different problems of dyeing would take more time than I have for this entire talk. Certainly many dyeing problems remain unsolved after years of work on cotton, wool and viscose rayon. In general, we have found how to get the dye molecule into their structures but frequently we have difficulty in making it stay there. A common example is ribbed cotton socks which, even though carefully laundered, eventually crock preferentially along the ribs. I wonder whether anyone has worked on this problem with due recognition of the difference in stress systems in the ribs as compared to the areas between ribs. Perhaps this slant is entirely wrong but something should be done about this "pattern crocking."

The number of dyeing problems has been multiplied many times with the introduction of the hydrophobic synthetic fibers, particularly the acrylics. Here the normal swelling is so small that it is difficult to introduce the large dye molecule into the structure. In some cases, acetate

dyes work pretty well, of course, and a number of clever chemical tricks for introducing the dye molecule have already been devised. Certainly great strides will be made by the able chemists of the fiber-producing organizations in solving these dyeing problems; otherwise, the hydrophobic fibers will never find wide acceptance. Another reason for optimism is that there is also quite a lot of fundamental research on dyeing going on. I rather suspect, for example, that the work of Dr White and his group at TRI, who are employing radioactive tracer techniques to study dyeing phenomena, will yield valuable basic data of eventual practical importance. But suppose we now drop the subject of dyeing problems, recognizing their importance and the need for both applied and fundamental research in this field.

STATIC ELECTRICITY——Static electricity is not exactly a new problem in textile processing and, under very dry conditions, static electricity was known as a product problem also. However, the hydrophobic synthetics are intrinsically better dielectric materials than the old fibers and, because of their low moisture absorption, they generate reasonably large quantities of charge even at high humidities. From the product angle, this static generation is truly serious since it results in unsightly dust collection on dark-colored fabrics under conditions of wear and in lint collection during laundry drying. Already considerable progress has been made in the development of antistatic finishes and some are supposed to be staple to laundering and dry cleaning. However, the age-old problem of "triboelectricity" is one which has never been completely elucidated. It is known that there are factors other than high sensitivity which influence frictional charge-generation — one of them is a property analogous to the contact difference of potential of conductors. Thus there is room for some good, sound physical-chemical research on the basic nature of triboelectric effects in the hydrophobic fiber materials in relation to their molecular structures. One of our TRI Research Fellows is working very hard on this difficult but interesting problem under a Participating Fellowship grant of Carbide and Carbon Chemicals Division of Union Carbide. I am sure all of you who are concerned with the new synthetic fibers wish him success.

PILLING——Pilling is another difficulty which has become prominent with the introduction of the synthetics. It is known that pilling takes place to some extent with wool, viscose rayon, and acetate but, because those fibers are so much weaker than nylon, dynel and Dacron, the protruding fibers break off before the balling up or pilling develops to a serious stage. At any rate, pilling with the high tenacity fibers is an exceedingly tough problem and it shows up even in 50-50 blends with wool, not to mention 100% synthetic fiber blankets and socks. Apparently some of the strong hydrophobic fibers pill much less than others. Perhaps someone knows why—I don't. Obviously, less pilling will be observed with a heavier denier fiber or with a longer staple, but this is no comfort when a fine short staple fiber is desired for other good reasons. Undoubtedly, work is being done on the nasty pilling problem, probably from the standpoint of its dependence upon yarn and fabric constructions. It would seem, however, that the first task is to break the complex pilling effect down into the several contributing simple effects which must exist. Once the true nature of pilling is known, perhaps something can be done about it.

WICKING——Wicking is another unpleasant characteristic of the hydrophobic synthetics. This peculiar phenomenon whereby water penetrates rapidly through a fabric although the base fiber of that fabric absorbs only minute amounts of water, deserves a great deal of attention. It is rather ironic when one considers the remarkable crease resistance properties of Dacron, for example. As you know, a pair of Dacron trousers can be laundered with no loss of crease. However, if one wears them in the rain, every impinging raindrop wicks right through to the skin, resulting in a most uncomfortable situation. Sure enough, there will be no loss of crease or shrinkage, as would occur with wool, but wool trousers in the rain feel relatively wonderful. Clean wool, it appears, is a pretty good water repellent. Obviously, the wicking effect is largely a function of surface wetting or "contact angle" but it seems possible that yarn and fabric geometry are also factors. At any rate, here is another new problem which deserves attack on the fundamental plane.

LOCAL MELTING——Yet another problem introduced by the synthetics is their property of melting to form a small hole in a garment upon which a spark falls from a pipe or cigarette. Even dynel, which does not burn at all, melts under this condition. Obviously, some reduction of this difficulty can be achieved by developing fiber materials with higher melting temperatures, but there is undoubtedly a limit beyond which it would not be practicable to go. The obvious fact is that the present synthetic fibers do melt, and it almost seems that smokers will have to develop more careful habits if they are to wear garments of the synthetic fibers; perhaps we should go back to chocolate cigars—I noticed some for sale the other day.

CONCLUSION

We could enumerate other new problems presented by the synthetic fibers—some of them melt and burn in a nasty manner after melting, some don't burn at all; some require rather low ironing temperatures, some do not; some go to pieces rather badly in outdoor weathering, others are remarkably good in this regard. Some have an unpleasant clammy feel next to the skin, others give a rather pleasant contact sensation; some of the synthetics show a tendency to soil very rapidly although the soil is easily removed, others retain the soil very tenaciously. There is a definite question whether hydrophobic fibers are suitable for underwear or shirting fabrics. If it develops that they are not, we can look for new synthetics with higher moisture absorption. But the purpose of this talk is not to damn the synthetic fibers singly or collectively; it is only to bring out the natures of the problems which still face the textile research man. He must solve these problems and I'm willing to bet that he will—then the remarkable virtues which he has built into his fibers can come into true focus. The same statement can be made in regard to cotton and wool, truly remarkable fibers, but fibers which can stand improvement in some respects. The research man will probably make some of the desired improvements and it is quite possible that entirely new markets for cotton and wool may develop, perhaps partly because of the impact of the synthetic fibers.

We are now going through a period of vigorous argument between proponents of the natural fibers and those who are developing the synthetics. It seems safe to say that complete objectivity has not always been maintained in the statements of both sides. Occasionally, a government official or a popular writer has added fuel to the fire with broad statements based on inaccurate information. According to a label I saw recently on a sweater, it was knit of 100% "virgin nylon". This, of course, indicates the absence of reworked nylon, but one is tempted to suspect that the synthetics are bent not only upon assuming some of wool's sterling properties but also upon sharing its high moral standards. The natural vs synthetic fibers debate will continue, of course; it is a natural and, in some respects, healthy symptom of a period of transition in the textile field. But the final division of the market among the various fibers will be a function of just three variables: availability, price, and superior properties for each application. Research, fundamental and applied, will have a profound effect upon each of these three factors. Much of this research effort undoubtedly will be exerted by the organic chemicals industry in the quest for the many pots of gold revealed by the "textile rainbow".

Proceedings of the
American Association of Textile Chemists and Colorists

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PRELIMINARY INVITATION TO CONTRIBUTE TECHNICAL PAPERS AT 1952 CONVENTION

PREPARATIONS for the technical program at the 1952 National Convention, to be held in Boston, Mass, Nov 6-8, are now underway. Persons desiring to present a paper should proceed according to the following established instructions and regulations:

(1) Notify Ernest R Kaswell, Convention Technical Chairman, Fabric Research Laboratories, Inc, 665 Boylston St, Boston 16, Massachusetts, as soon as possible, giving the title of the proposed paper. The time required for the presentation should be stated (30-45 minutes).

(2) When the number of papers available is known, a selection will be made by the Committee, and the contributors will be advised as to whether their papers have been accepted. The program must be completed as soon as possible in order to assure the best possible arrangement of the papers and to provide adequate time for publicity.

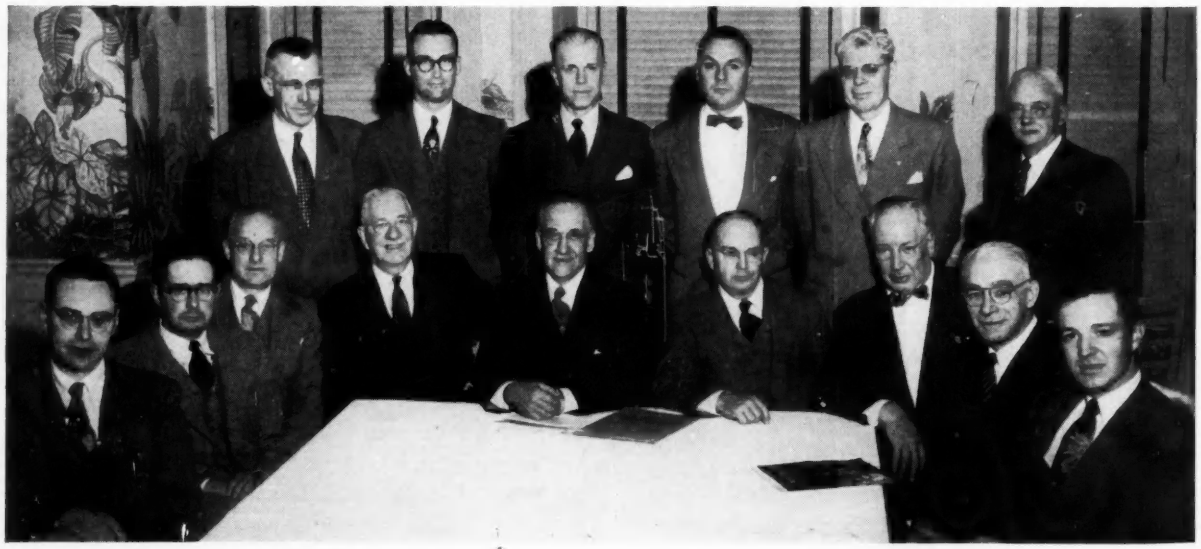
(3) An abstract of the paper will be required in advance of the program. Contributors will be notified of the date on which this abstract is required.

(4) Copies of the completed paper must be in the hands of the Technical Program Chairman by the first week of September so that the necessary arrangements for prompt publication may be set in motion. Earlier submission will be appreciated.

(5) Papers must not be primarily of advertising or promotional character. However, the subject matter may consider commercial products, machinery, instruments, or processing procedures of a commercial nature, provided that they are evaluated from a technical viewpoint.

(6) The Technical Program Committee must be the final judge as to which papers are to be accepted, but every effort will be made to include all suitable contributions in the program.

EXECUTIVE COMMITTEE, 31st NATIONAL CONVENTION



PICTURED above are members of the Executive Committee for the Thirty-First National Convention, which will be held under the auspices of the Northern New England Section in Boston, Nov 6-8, 1952.

Seated (l to r): Ernest R Kaswell, Fabric Research Laboratories, Inc, **Technical Program;** John M Gould, Barre Wool Combing Co, Ltd, **Registration;** Azel W Mack, Dexter Chemical Corp, **Printing;** Edward S Chapin, W C Durfee, Inc, **Reception;** George O Linberg, Belle Chemical Co, Inc, **Chairman;** Delbert E Ray, Roxbury Carpet Co, **Exhibits;** Albert E Sampson, National Aniline Division, **Entertainment;** Hyman P Selya, Sagamore Color & Chemical Co, **Publicity;** Rogers B Finch, Massachusetts Institute of Technology, **National Technical Committee.**

Standing: Philip S Durfee, W C Durfee, Inc, **Finance;** Harry M Hartnett, General Dyestuff Corp, **Hotel;** J Milton Washburn, Jr, Emery Industries, Inc, **Alumni Luncheon;** Joseph A Bryant, Jr, Bryant Chemical Corp, **Dining;** G Nathan Reed, Lowell Textile Institute, **Ladies;** Lester Conner, Bryant Chemical Corp.

Missing when this photograph was taken: C Wendall Lever, Goodall-Sanford, Inc, **Chairman Ex-Officio;** Harold C Chapin, Lowell Textile Institute, **Personnel;** Walter J Hamburger, Fabric Research Labs, Inc, **Assistant Chairman;** and A Frederick Baggeson, The Bell Co, **Transportation.**

Calendar of Future Meetings

COUNCIL: April 18, June 13, Sept 19 (all in New York); Nov 6 (Boston).

GENERAL RESEARCH COMMITTEE: Dates and sites are the same as the Council's.

NATIONAL CONVENTIONS: 1952—November 6-8, Boston, Mass; 1953—Sept 17-19, Hotel Conrad Hilton, Chicago, Ill; 1954—Atlanta, Ga.

HUDSON-MOHAWK SECTION: Mar 21, May 2 (all at Jack's Restaurant); June 20 (Annual Outing).

MID-WEST SECTION: February 16 (Hotel Bismarck, Chicago, Ill); April 19 (Cincinnati, O); June 14 (Lake Lawn Lodge, Delavan, Wisc); October 4 (Hotel Bismarck, Chicago, Ill).

NEW YORK SECTION: Feb 29 (Hotel McAlpin, New York); April 18 (Swiss Chalet); May 16 (Swiss Chalet); June 20 (Outing).

NORTHERN NEW ENGLAND SECTION: Mar 7 (MIT); April 18 (LTI); May 16 (Andover Country Club); June 6 (Annual Outing, Merrimack Valley Country Club); Dec 6 (1952 Annual Meeting, LTI).

PACIFIC SOUTHWEST SECTION: March 28, 1952.

PHILADELPHIA SECTION: March 7 (Penn-Sheraton Hotel, Philadelphia); April 25 (Abraham Lincoln Hotel, Reading, Pa); June 13 (Outing, Lu Lu Temple Country Club, North Hills, Pa).

PIEDMONT SECTION: April 25-26 (Clemson Hotel, Clemson, S C); June 6-7 (Ocean Forest Hotel, Myrtle Beach, S C); Sept. 12-13 (Hotel Charlotte, Charlotte, N C).

6RHODE ISLAND SECTION: Feb 29 (Johnson's Grille, Providence, R I); Mar 28 (Providence Engineering Society); April 25 (Wannamoisett Country Club); May 23 (Providence Engineering Society); June 6 (Annual Outing—Wannamoisett Country Club); Oct 24 (Providence Engineering Society); Dec 5 (Annual Meeting, Sheraton-Biltmore, Providence).

SOUTH CENTRAL SECTION, Feb 16, May 17 (Patten Hotel, Chattanooga, Tenn); Aug 22-23 (Summer Outing, Chattanooga Golf and Country Club); Dec 6 (Patten Hotel).

SOUTHEASTERN SECTION: Feb 23 (Alabama Power Company Auditorium, Talladega, Ala).

WESTERN NEW ENGLAND SECTION: March 14 (Danbury, Conn); May 2 (Ladies Night, Cheshire, Conn); June 20 (Outing); Oct 3, Nov 14 and Dec 12 (Rapp's).

Special Communication——

A SMALL COMMENTARY FROM A SMALL COUNTRY*

Re: "What's New in Spectrophotometry"

H J SELLING

Vezelinstituut TNO, Delft, Holland

THE important paper by E I Stearns in the *American Dyestuff Reporter* (Sept 3, 1951, P563) I have read with much interest. The great number of applications of color measurement in the textile industry mentioned is certainly most impressive and a useful support to every propagandist in this field.

However, the way in which the author has treated the economical aspects of the problem is, in our opinion, too one-sided. One might easily draw the incorrect conclusion from this paper that color measurement can only be carried out by means of a recording spectrophotometer.

Color measurement must produce commercial advantages in every textile mill where goods are dyed. It is extremely doubtful, however, whether these economical advantages are so important that the mills (at least the smaller ones) can afford the laboratory, the library, the skilled technician, etc, mentioned in the paper under discussion.

An expensive, automatic spectrophotometer is by no means always necessary. For many of the applications of color measurement in the textile industry mentioned, the complete reflection curves need not be measured because the estimation of the tristimulus coordinates X, Y and Z alone suffices. These X, Y and Z values can be measured very rapidly by means of an inexpensive photoelectric colorimeter with an accuracy which is mostly quite satisfactory for practical purposes.

For the solution of the problem "Determination of Dye Concentrations for New Shades" we therefore take a different point of view:

a) The results of research must also be applicable by means of a cheap instrument for color measurement.
b) The solution of the problem must be brought into a simple form, so that it can be used without computations.
c) The time required for the estimation of a dyeing formula for a desired shade must be very short.

The inevitable consequence of the three above-mentioned conditions is that the solution of the problem is confined within certain limits by using three selected dyes. Is this a great disadvantage? It goes without saying that a single set of three dyes is by no means sufficient for all dyeings. For both commercial and technical reasons it will be necessary to have a number of sets of three dyes at one's disposal. However, within a given category of dyeings, e g, the acid dyes for wool, or the direct dyes for cotton, a considerable proportion of all desired shades can already be covered with one set of three dyes, viz, three selected bright, fast-to-light acid dyes or three selected bright, fast-to-light direct dyes. Roughly estimated, it is possible to obtain something like 100,000 visually different shades with one set of three bright dyestuffs.

In practice, given shades are frequently imitated by using combinations of certain concentrations of one set of three dyes, although this is often done for quite different reasons. A misunderstanding of our fundamental standpoint may have been the cause that in Stearns' description of our solution of the problem "Determination of Dye Combinations for New Shades" several misstatements have crept in. That is the reason that I shall give a short survey of our method.

The color of a reflecting surface in a certain source of light (e g, daylight) is absolutely defined by the values of the tristimulus co-ordinates X, Y and Z. It is generally known in color measurement that these quantities are proportional to the sums of the reflections at the selected wavelengths, so that

$$X = K_1\Sigma_x R; \quad Y = K_2\Sigma_y R; \quad Z = K_3\Sigma_z R.$$

Several equations are known for the relation between the reflection of the incident radiation at a certain wavelength on the one side and the concentration and adsorptive capacity of the dye(s) present in the fabric on the other side. The equation that is most frequently used is that of Kubelka and Munk. For (e g, three) dyes absorbing the light independently of

* Mailed on October 24, 1951, as a special communication to the *Proceedings* from Dr H J Selling.

each other (dyes 1, 2 and 3), this relation is

$$\frac{(R - 1)^2}{2R} = k/s_1c_1 + k/s_2c_2 + k/s_3c_3 + (k/s)_u$$

In which R is reflection of dyed fabric. $k/s_{1,2,3}$ are the KM constants for the three dyes.

$c_{1,2,3}$ are the concentrations of the three dyes in the fabric. k/s_u is the KM constant of the undyed fabric.

This relation can also be put in the form:

$$R = 1 + \sum_{1\,2\,3} k/sc + (k/s)_u - \sqrt{\left(\sum_{1\,2\,3} k/sc + k/s_u\right)^2 + 2\left(\sum_{1\,2\,3} k/sc + k/s_u\right)}$$

Using this last relation, the sums of the reflections at the selected wavelengths and, therefore, X Y and Z can be expressed in terms of the concentrations of the dyes 1, 2 and 3:

$$X = K_1\Sigma R_x = K_1\Sigma\left[1 + \left(\sum_{1\,2\,3} k/sc + k/s_u\right) - \sqrt{\left(\sum_{1\,2\,3} k/sc + k/s_u\right)^2 + 2\left(\sum_{1\,2\,3} k/sc + k/s_u\right)}\right]$$

[1] $$Y = K_2\Sigma R_y = K_2\Sigma\left[1 + \left(\sum_{1\,2\,3} k/sc + k/s_u\right) - \sqrt{\left(\sum_{1\,2\,3} k/sc + k/s_u\right)^2 + 2\left(\sum_{1\,2\,3} k/sc + k/s_u\right)}\right]$$

$$Z = K_3\Sigma R_z = K_3\Sigma\left[1 + \left(\sum_{1\,2\,3} k/sc + k/s_u\right) - \sqrt{\left(\sum_{1\,2\,3} k/sc + k/s_u\right)^2 + 2\left(\sum_{1\,2\,3} k/sc + k/s_u\right)}\right]$$

With the above-mentioned set of equations for X, Y and Z the problem of "Determination of Dye Combinations for New Shades" has been solved *in principle.*

By means of an inexpensive photoelectric colorimeter the X, Y and Z values of the pattern to be matched are estimated.

If the coefficients $k/s_{1,2,3}$ at all selected wavelengths are known, [1] is only a set of three equations having as the three unknowns the concentrations c_1, c_2 and c_3 in which the dyes 1, 2 and 3 must be mixed in order to obtain a color after dyeing with the same tristimulus values X, Y and Z as the pattern to be matched.

The solution of the equations [1], in which the theoretically exact values for the attainment of a color match are formulated, can be found best by a graphical method. The geometrical meaning of the equations [1] enables us to understand how this system of graphs is used.

For a known, measured value of X the first equation in [1] represents the analytical formulation of a curved plane in a dye concentration space in which on the coordinate axes the concentrations c_1, c_2 and c_3, respectively of the dyes 1, 2 and 3 are plotted. The coordinates of every point of this plane are the concentrations which, after dyeing, will produce a color of which the tristimulus value X corresponds with the measured value of X of the pattern to be matched.

The equation for Y also represents the analytical formulation of a similar, but a different, curved plane in the concentration space. The line of intersection of the X and Y planes represents all points that have as co-ordinates those concentrations which, after dyeing, will produce an X value and a Y value identical to those of the pattern to be matched.

The Z equation also represents a curved plane in the concentration space. The point of intersection of the Z plane and the line of intersection between the X and Y planes has three co-ordinates which indicate the concentrations of the dyes 1, 2 and 3 which upon dyeing, will produce a color with the same X, Y and Z values as the pattern to be matched, so that the produced shade is a perfect match of the color of that pattern in daylight.

In the series of X graphs the curved planes for various X values are shown as contourlines for a number of concentrations of the yellow component projected on the coordinateplane of the concentrations of the red and blue components. The same system is used with the Y and Z graphs. By means of these graphs the construction of the line of intersection and the ultimate point of intersection can be carried out in a very rapid and simple way.

For drawing the graphs by means of the equations [1], the absorption coefficients at the selected wavelengths must be known and they must be measured by means of a spectrophotometer. If it is assumed that the Kubelka-Munk law holds good in the case under discussion, the whole set of diagrams can be computed from three dyeings only. It is, generally speaking, to be preferred to study the validity of this law by means of a great number of dyeings in order to find out whether it has to be modified or even completely replaced by some empirical formula. As the concentrations $c_{1,2,3}$ in [1] are the concentrations on the fabric and we have to know the concentrations in the dyebath, it is in the case of incomplete exhaustion of the bath preferable to relate the concentrations in the dyebath to the reflection of the dyed fabric by means of some empirical formula.

For a complete set of diagrams for acid wool dyes a total of about 200 dyeings has been made. By measuring the X, Y and Z values of the 200 dyed patterns the color prediction graphs, which can be used for matching something like 100,000 different shades, were computed.

For two sets of three prechromated dyes the above-mentioned law could also be reasonably well used. For a set of three direct cotton dyes, on the other hand, a far larger number, viz, over 700, dyeings had to be made on account of considerable variations in duplicate dyeings, exhaustion rates and marked deviations from the Kubelka-Munk law.

Although it is feasible that the textile manufacturer produces the necessary sets of graphs himself, it is probably more efficient if the dyestuff manufacturers issue the series of graphs to be used for sets of readily miscible dyes.

In this connection I mention that in a few months' time a Dutch dyestuff manufacturer will issue such a graphical system of color prediction for a set of acid dyes.

I'll wind up by commenting on the description of my lecture and demonstration. I am sorry to say that they were not so romantic as Stearns suggests. My associate did not cycle to a spectrophotometer, because he used a simple photoelectric colorimeter which he carried with him. The dyeing formulas of the three patterns to be matched (inclusive of the measurements) were estimated by him within 30 minutes and

were communicated in an American, business-like way by telephone to the laboratory of a textile mill in the same town. At the end of the lecture the dyer entered the lecture room and handed over the dyed patterns to the chairman. A comparison of these samples and the patterns to be matched showed, according to the textile specialists present, that the dyer had obtained a very satisfactory color match, although he had never seen the patterns to be matched.

COMMENTS ON SELLING'S COMMENTARY*

E I STEARNS
Calco Chemical Division,
American Cyanamid Company

IN OUTLINE, the following points are brought out in this commentary: 1) The reader (of Stearns' article) should not infer that a spectrophotometer is necessary for color matching, for in truth a photoelectric colorimeter will suffice. 2) In order to solve practically the problem of "determination of dye concentrations for new shades", it is necessary to limit the solution to three previously selected dyes. 3) The color matching method of Selling is presented. 4) The description of Selling's demonstration (by Stearns) is inaccurate.

With reference to the first point I had not meant to imply that only a spectrophotometer can be used for colorimetric problems in a textile mill. The title of the paper is "What's New in Spectrophotometry". The purposes of the article, as they are stated in the text are: 1) To recommend formulas for spectrophotometric use. 2) To recommend methods of interpretation of spectrophotometric data. 3) To present data helpful in answering the question, "Is a spectrophotometer economically advantageous to a mill?" It might be interesting to have an additional article on the subject "What's New in Colorimetry". However, the article in question was not intended to discuss the advantages and limitations of various color-measuring instruments. I am very glad that Selling's commentary gives me the opportunity to emphasize that this implication was not intended.

In regard to Item 2, again I agree with Selling. I did not quite say that a solution limited to three selected dyes was the only practical method. But I did say the method of calculation from three standard curves that may be chosen at will is impractical. I think that if I were to rewrite the article, I would subdivide this application of the spectrophotometer into two sections: 1) Color matching with three standard dyes which have been previously subject to rather extensive experimentation and calculation, and 2) color matching with any three dyes from individual standard curves. In practice, matches obtained visually are not limited to three standard dyes, but include specific dyes chosen because they are economical, easy to control or of superior fastness. Hence subdivision 2) mentioned above is desirable even though its solution has not yet been made practical.

With reference to Item 3, the commentary contains a good summary of the method of Selling. Equations [1] in the commentary present the big problem of color matching. The problem is how to solve these equations practically. Dr Selling believes these are best solved graphically. We have solved them by successive approximations *(1)*. We have also designed instruments to solve these equations *(2)*. However, I do not wish to disagree with the proposal that the equations are best solved graphically.

With reference to Item 4, I have not had the pleasure of seeing one of the color-matching demonstrations by Selling. I was relying on a verbal description of it from someone who had attended one, and apologize for any inaccuracies. The reference to the bicycle was not meant to imply any romance, rather it was meant to imply that the color-matching method of Selling could be applied with remarkable speed.

In summary, the only part of the commentary I disagree with is the title. Rather than being a small commentary, it is important in that it prevents a reader from making incorrect inferences from the article, and also presents a concise summary of the Selling method. I also disagree with the term "small country". It is small perhaps in geography and population but one has only to recall the names of Rembrandt, Van Gogh, Van der Meer, Van Leeuwenhock, Van't Hoff, Van Musschenbrock and Huygens to realize that in the things that count, such as contributions to art and science, the adjective small does not properly describe Holland.

REFERENCES

(1) R H Park and E I Stearns, *J Opt Soc Am* 34, 112 (1944).
(2) E I Stearns, U S Patent 2,540,797 (1951).

* Received from Dr E I Stearns for publication in reply to the communication from Dr H J Selling.

Meeting Report—— New York Section

January 11, 1952
Hotel New Yorker, New York

A MEETING of the New York Section was held on Friday evening, January 11th, 1952 at the Hotel New Yorker, New York, N Y. A social hour and dinner preceded the meeting.

The Chairman, Paul J Luck, read a communication from Dow Corning inviting members to attend an exhibit on silicones. Reporting for the Convention Committee he stated that the Convention had made a net profit of $24,441.63 with the exhibits accounting for a little over $13,000 of this. The remainder of the profit was due, not to high fees, but to good management in determining how many of those who purchased tickets for the lunch and banquet would actually attend.

The speaker was Henry E Millson, Calco Chemical Division, American Cyanamid Company, who discussed "Microscopic Dyeing Phenomenon—Studies with the Microdyeoscope". This was illustrated with Kodachrome slides.

The attendance was approximately 175.

Respectfully submitted,

NORMAN A JOHNSON,
Secretary

NOTICE TO AUTHORS OF PAPERS

MANUSCRIPTS for the *Proceedings* and for other publications of the American Association of Textile Chemists and Colorists shall conform to the requirements and standards given in this *Notice,* which was drawn up after considerable study. Before publication, manuscripts for the *Proceedings* shall be approved by the Editor, not only for editorial correctness according to the standards of this *Notice,* but also for content of technical matter. In his work, the Editor may enlist the aid of anonymous reviewers who are selected for expert knowledge in particular fields.

It is presumed that authors in studying the comments of reviewers and of the Editor will remember that all recommendations are made in a kindly, helpful, sympathetic manner to improve the paper in both literary and technical excellence. Although authors should cheerfully consider suggestions, they are expected to defend their position if justified, especially when strictly technical matters are involved with which the authors have an intimate knowledge.

MANUSCRIPTS—Manuscripts shall be typewritten double-spaced with approximately one-inch margins on 8.5 x 11-inch white paper. In addition to the original, at least one carbon copy is required. Pages are to be numbered consecutively with Arabic numerals, and each page after the first shall carry the authorship at the very top. Tables and figures shall also be numbered consecutively, the tables with headings containing Roman numerals as TABLE I, TABLE II, etc, and the figures with Arabic numerals as Figure 1, Figure 2, etc, appearing *below* the figures. The names of the authors and their laboratories or business connections should appear below the title of the paper.

ARTICLES APPEARING IN THE "PROCEEDINGS" IN RECENT ISSUES OF THE "AMERICAN DYESTUFF REPORTER" will be helpful to authors as models of form for the typing of manuscripts.

LITERARY STYLE AND FORM OF PRESENTATION—In the writing of papers, authors are requested to observe a trenchant, simple style of writing directed to textile chemists and colorists with at least an elementary knowledge of chemistry, physics, mathematics, engineering, textile processes and textile machinery.

In the organization of the material, there should be one or more introductory paragraphs setting forth the occasion, significance and main objectives of the paper and of the method of attack. This should be followed by the body of the presentation, either with discussions interspersed throughout this portion or with a collected section marked "DISCUSSION" after the main body of the paper. Finally, there shall be a brief section at the end entitled "SUMMARY" or "CONCLUSIONS."

Center headings should be employed sparingly and generally will include only very important section headings, such as "INTRODUCTION," "EXPERIMENTAL," "DISCUSSION," "CONCLUSIONS," "SUMMARY," and "REFERENCES." Side headings (see third paragraph of this *Notice* for an example) shall be indented and run into the text to which they apply, and shall be separated from the paragraph by a dash. The publisher will print center headings in bold-face capitals and side headings in capitals.

LITERATURE REFERENCES AND FOOTNOTES—References to the literature and all footnotes (except those in tables) shall be numbered consecutively with underlined Arabic numerals in parentheses at the proper place in the text. Where a reference or footnote is to be used again, the original number is simply repeated; this obviates the necessity of repeating the footnote or reference at the bottom of the page. References to the literature shall conform to the universal usages followed by *Chemical Abstracts,* which include underlining of book and journal names to indicate italicization in printing.

The spelling and rules of punctuation followed in manuscripts shall be those found in the *Merriam-Webster New International Dictionary;* abbreviations and chemical formulas shall conform to *Chemical Abstracts.* Periods shall be used only at the end of sentences, not after abbreviations.

FIGURES AND GRAPHS—Figures and graphs should be black line drawings on white drawing paper. Photographic prints are acceptable, preferably glossy prints on double-weight paper. Duplicates should be available for dispatch to reviewers. Diagrams and graphs should preferably be designed in long form to cover one column of print but may be two columns wide or the width of a full page where necessary. In graphs the frame and actual curves should be inked more heavily than the co-ordinate lines, and these latter should not be too close together. Various styles of broken lines are sometimes desirable to distinguish curves. Experimental points should be given with small plane figures, such as circles, squares, diamonds or triangles. Numbers and legends on co-ordinate axes are to be lettered in the graph by the author. Numbers and titles of figures should be placed below the diagram or on the edge of the back. Each piece of illustration copy should bear on the margin or on the edge of the back the name of the author and the title of the paper.

Photographs of authors should be included with copy, to be run in conjunction with the paper. These must be on glossy stock, and should be large enough for proper reproduction.

TABLES—Tables should not be used indiscriminately because they are very expensive to set up in type. They should be designed to be one column, two columns or three columns wide. Tables should be arranged with the view of conserving space; column headings should be short and abbreviated. Quantity designations shall never appear in the body of the table but in the headings. Tables, if possible, should be placed in the manuscript where they belong rather than separately.

SYNOPSIS—A separately written synopsis of not over 200 words containing the gist of the subject matter must accompany every manuscript.

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TRADE-MARKS — As the AATCC wishes to co-operate in the protection of trade-marks, a list of all trade-mark names mentioned in an article will be placed in a separate paragraph ahead of the list of references. The author will therefore prepare such a list in capital letters under a center heading entitled "TRADE-MARKS", under which should appear the following sentence: "The following names used in the article above are trade-marks for the kinds of products for which the generic name follows the trade-mark name:"

To simplify editing and printing, it is requested that, in the body of the article, trade-mark names be written with only an initial capital letter and with no other references.

Courtesy demands that authors include competitive products as well as those of his firm. Many current trade-mark names are to be found in the *AATCC Technical Manual and Yearbook.* Examples of how trade-marks should be given in the paragraph for trade-marks are as follows:

ORLON, an acrylic fiber
NIAGARA, a direct dye
IGEPON, a synthetic detergent.

South Central Section——

THE DYEING OF NYLON, ORLON† ACRYLIC FIBER AND DACRON† POLYESTER FIBER*

S G TURNBULL, JR

E I du Pont de Nemours & Co, Inc

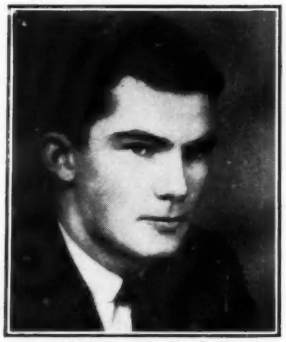
INTRODUCTION

YOUR program chairman, Dr Luther, has requested me to talk specifically on the dyeing of the man-made fibers, nylon, Orlon and Dacron, with the thought that at some future date you may desire a talk on the mill processing of these fibers and on methods for finishing piece goods.

Prior to getting to the heart of our subject, however, I would like to speak briefly about the future in the next decade of the newer man-made fibers. Over the past six months there have been many statistics bandied about in trade journals. Perhaps it would be wise to analyze these briefly, so that we can understand the relationship of the man-made fibers to our two most important natural fibers, cotton and wool, which have served mankind so well for such a long period.

Viscose and acetate rayon are now strongly entrenched in the textile trade. These are only partially man-made as Nature provides us with the polymer, cellulose, on which they are based. Well over a billion pounds are now consumed annually in this country.

Of the remaining synthetic fibers, nylon is the only one that has really graduated from its infancy. We all know of its many outstanding properties and uses in the textile field. Its position will be even stronger when the Chemstrand nylon plant at Pensacola comes "on stream".



S G Turnbull, Jr

A representative of a large manufacturer of the older regenerated fibers, acetate and rayon, and of the first wholly man-made fiber, nylon, discusses the properties and especially the dyeing of nylon and of the two new wholly man-made fibers also manufactured by his firm, namely, Orlon acrylic fiber and Dacron polyester fiber.

Nylon is characterized as the most dyeable of the three fibers; it can be effectively colored with acetate, acid, chrome, basic, naphthol, and Capracyl dyestuffs. The advantages, uses, and fastness properties of the different dyestuff classes on nylon are explained. The problems of dyeing filament and staple nylon and blends with nylon are discussed. In the dyeing of Orlon acrylic fiber it is shown how the copper salt-hydroxylamine technique is applicable near the boil, and how better results are possible at a temperature of 250°F attainable with pressure. Vats, leuco esters of vat dyes, acetate dyes, acid dyes, basics, and some azoics are applicable to Orlon.

Dacron polyester fiber can be dyed practically only with acetate, developed acetate, and some azoic combinations. The uses of carriers in the dyeing of Dacron at the boil is fully discussed, and the importance of using pressure to dye at 250°F is emphasized.

An explanation of the techniques by which blends of Dacron with other fibers can be colored closes the paper.

It has been stated *(1)* that "by early 1953, the combined annual production of Du Pont and Chemstrand is estimated to reach 240 million pounds of nylon".

The potential rapid growth of Orlon, Acrilan, and Dynel acrylic fibers, Dacron polyester fiber, and other synthetic fibers over the next ten years has been discussed at length elsewhere *(1, 2)*. It has been stated that the output of nylon, the polyacrylics, polyethylene, polyvinylidene chloride, glass and protein fibers will probably reach 500 million pounds by 1958, and 750 million to one billion pounds by 1960.

In the Daily News Record of Oct 9, it was indicated that over the past 30 years consumption in the U S of man-made fibers increased to almost 1½ billion lb. However, in this same period consumption of cotton increased by 1,891,000,000 pounds, and wool consumption increased by 322 million pounds. The total increase of the natural fibers of 2,213,000,000 pounds thereby surpassed the 1½-billion increase of man-made fibers. These statistics should prove that the natural and synthetic fibers both have an important role in our nation's economy and can live side by side in harmony.

Most of you are familiar with the violent fluctuations that can occur in the prices of natural fibers. Fine Australian wools, for example, that sold at $3.00-$4.00 per pound in late 1950 and early 1951 decreased to about $1.65 per pound on Sept 16. In the next three weeks the price rose to $2.40 per pound, an increase of almost 50%, and then declined about 30% in the following week.

As the cost of manufacture of the man-made fibers undergoes much less variation than that cited above, greatly increased production in the next decade should aid materially to stabilize this price variability of the natural fibers. This should prove to be a blessing all along the line to those who must worry about inventories, including cotton farmers, sheep producers, mill men, converters, retailers, the Armed Forces, and ultimately the taxpayers.

Having used approximately six minutes of our allotted time to give you this background, I should like to discuss with you over the next six minutes some of the properties of our newer fibers which make them attractive to the textile trade.

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* Presented at the Hotel Patten in Chattanooga, Tenn, before the South Central Section on Dec 1, 1951.

† The names, "Orlon" and "Dacron," are Du Pont registered trade marks for acrylic and polyester fibers, respectively. Whenever these names are used alone, it is to be understood that they stand for the generic names, "acrylic fiber" and "polyester fiber," respectively.

The following trade names, which appear throughout this article, are also Du Pont registered trade marks: Capracyl, Chromacyl, Ponsol, Duponol, Naphthanil, Acetamine, Celanthrene, Sulfanthrene and Pontacyl. "Acrilan" is a registered trade-mark of the Chemstrand Corporation, and "Vicara", a registered trade-mark of the Virginia-Carolina Chemical Corp.

GENERAL CHARACTERISTICS OF SYNTHETICS

NYLON —— Nylon is a polyamide made by condensation of hexamethylenediamine and adipic acid. It is a melt-spun fiber produced at our three plants in Seaford, Delaware; Martinsville, Virginia; and here in Chattanooga. It is outstanding because of its versatility, as it is used in all types of constructions from sheer hose to heavy hawsers, and in blends with cotton, wool, acetate, viscose, silk, Vicara and Dacron polyester fiber. This versatility is a resultant actually of a number of its properties, as it has high strength, extreme durability, sheerness if desired, and, of most importance to the consumer, its "easy-living" characteristics. In filament form it finds use in the industrial field in laundry nets, filter fabrics, airplane and truck tires, belts, Hoffman press covers, etc. In the apparel field it is converted to knitted fabrics, such as women's hose, tricot knit underwear, blouses and lingerie, simplex knit gloves, and goes also into woven shirtings, dresses, lingerie, and a host of other uses. Staple nylon finds use in drapes, upholstery, work and play clothes, men's hose and sweaters.

ORLON——Orlon acrylic fiber is made from an acrylonitrile polymer by the solvent-spinning system. Our May Plant at Camden, South Carolina, is already producing large quantities of continuous-filament yarn, and staple will come into production on a commercial scale in 1952. In the meantime, staple is being produced on a pilot plant scale at Waynesboro, Virginia.

In filament form Orlon acrylic fiber is said to have a warm, dry, silk-like hand, high strength and durability, easy launderability, and other properties that will aid its entry into many apparel uses. It should also be quite useful in the industrial fabrics field as it is extremely resistant to sunlight, acids, weather, atmospheric gases, and mildew. These same properties will promote its use in awnings, auto tops and outdoor furniture.

Unlike nylon and Dacron polyester fiber, which are round in cross-section, Orlon has an irregular perimeter, being "dog-bone" in shape. This, coupled with its low specific gavity of 1.17 (wool, 1.32) endows it with high bulking power, desirable for suits and overcoats.

DACRON——Dacron polyester fiber is made by melt-spinning the polymer formed from condensation of ethylene glycol (antifreeze) and terephthalic acid, which in turn is produced by oxidation of p-xylene supplied by the oil industry. In properties, it more closely resembles nylon than Orlon, but in addition has other outstanding properties peculiar to it alone. These include its high heat and stretch resistance in filament form, while as a staple fiber it has high resilience and shape-retention properties, being much superior to wool, particularly when exposed to high humidity, as in the summertime. Dacron is little affected by moisture.

As a result of these above-stated properties, Dacron in filament form should find wide use in V-belts, fire hose, dresses, shirtings, blouses, curtains and sewing yarns. In staple form it will be used for suitings, men's hose, knitted wear and other similar end uses.

At the present time Dacron polyester fiber is being produced on a pilot-plant scale in both filament and staple forms at our Seaford nylon plant. We are currently constructing facilities for commercial manufacture at Kinston, North Carolina. It is expected that operations there should commence in 1953.

Shape retention through most washing and dry-cleaning operations is one result of our ability to heat-set fabrics made from nylon, Orlon and Dacron fibers. This property will aid apparel manufacturers to supply the demand by the American public for "easy-living" fabrics.

We have consumed approximately one-third of our allotted time in giving you this background information. Now let us proceed with our discussion on the dyeing of these synthetic fibers made by the Du Pont Company.

DYEING SYNTHETICS

NYLON——Nylon is now in its thirteenth year on the American market. During this time we have learned nylon can be dyed readily with more dye classes than are applicable to any other commercial fiber. While the outstanding fastness properties of vat colors on cotton and on wool have not yet been obtained on nylon, we have learned to apply them more readily. There is some possibility that in the next decade we will learn how to obtain the excellent light fastness of the vat colors on nylon in commercial dyeing. It is known now that light fastness equal to that on cotton can be obtained by growing the vat pigment particles within the fiber to optimum size. We do lack a commercial method for this at the moment.

Nylon is readily dyed with acetate, acid, chrome, Chromacyl, basic and some direct colors. Naphthanil dyes can be applied, but lack the brilliance and light fastness possible on cotton, viscose and acetate. Over the years, selected old or established colors from the acetate and acid classes have been designated by their manufacturers as particularly suited for nylon. However, within the past two years, a new class of dyes designed particularly for nylon has been introduced. This new class of dyes, identified as "Capracyl" dyes by the manufacturer, has outstanding light fastness on nylon and is particularly suited for the dyeing of staple, top and tow going into upholstery, drapes, and similar end uses. The good wash fastness and neutral-dyeing properties of this class of dyes recommends its use in men's hose, and in blends with cotton and other cellulosics. The use of the Capracyl line is continuously increasing for nylon and for wool dyeing. In general, we can say that at the present time most of the lightweight nylon-filament fabrics are dyed with acetate colors. Heavyweight filament fabrics, staple and fabrics of spun nylon, and nylon blends with cotton and wool are usually dyed with the Capracyl dyes or with selected acid dyes. Because of the durability of nylon in prolonged use, the trend is continually towards faster colors.

Acetate dyes are used widely where good levelness accompanied by moderately good wash fastness is desired. This color type shows excellent transfer properties on nylon, and consequently is widely used to obtain optimum fabric appearance in piece-dyeing. As examples, we cite the use of acetate dyes for women's full-fashioned hosiery, lingerie, blouses, and similar gossamer garments. In addition, they are used for the dyeing of staple yarns for rugs and of knitting yarns in pastel shades, etc.

Acid, direct and Chromacyl dyes are used for heavier-weight nylon-filament fabrics, and for the dyeing of nylon staple in stock, top, fabric or garment form. While these classes are more difficult to apply levelly than the acetate dyes, and also in some combinations are accompanied by "blocking" in heavy shades, selected dyes do possess better light and wash fastness. Examples for the use of these types include filament auto seat covers, household upholstery and fish nets. Nylon staple articles dyed with these dye classes include men's and children's socks and sweaters. In general, we can say that on nylon, these classes are equal or superior in light and wash fastness, particularly the latter, in comparison with dyeings on wool.

Where excellent light fastness and wash fastness are required, the Capracyl dyes come into consideration. For example, medium- to heavyweight staple and filament fabrics dyed with this class include auto tops, work clothing, military fabrics, outdoor furniture, sports fabrics, etc. In addition, nylon staple for transportation upholstery, suiting blends,

and military fabrics is dyed with Capracyl colors. This class is also used for nylon staple in socks, men's shirtings, and drapes.

The light fastness of the Capracyl dyes on nylon is equivalent to that of selected vat colors on cotton. Wet fastness on filament fabrics is excellent. On staple fabrics the wet fastness is not quite so good as on the filament form. However, the wet fastness is improved to that of chrome colors by aftertreatment with tannic acid and tartar emetic.

Chrome colors are used in certain specific fields where excellent wet fastness is required, accompanied by moderate to good light fastness. Examples for nylon-filament yarns include sewing yarns and effect yarns for use in full-fashioned hosiery and suitings. Staple yarns for men's argyles are dyed with chrome colors, but selected acid, Capracyl and Naphthanil dyes are also used for this purpose.

While vat colors find most use for nylon-cellulosic fiber blends, being used to dye both components of the blend, they are also used for certain specific end uses on all-nylon fabrics. For example, Hoffman press covers, exposed to continued high heat in use, are dyed in tan, gray and brown shades with vat colors.

Basic colors find some use on nylon for fluorescent effects. A few shades with fairly good light fastness can be obtained, but in general the light fastness is about comparable to that on other fibers. The wet fastness is superior to that on most other fibers but inferior to that on pressure-dyed Orlon acrylic fiber.

Optical whites applicable to wool or cotton can also be applied to nylon. Certain types having good wet fastness are available. The light fastness is equal to that on cotton or wool.

A few generalizations can be given concerning fastness properties. The wet fastness of dyes on filament nylon is usually noticeably superior to that on spun nylon. However, to compensate, spun nylon is more readily dyeable. The light fastness of all color types, with the exception of vat colors, is noticeably better on bright nylon (no delusterant) than on semi-dull nylon, and appreciably better when compared with that on fully delustered nylon. Vat colors appear to improve in light fastness as the quantity of delustering component is increased, up to a certain concentration. It is believed that this is caused by increased crystal growth of the vat pigment in the "holes" left by the delusterant in manufacture.

NYLON BLENDS——For making nylon-wool blends, nylon staple can be stock-dyed, blended with stock-dyed wool, spun into yarn, converted into woven or knit piece goods and fabrics, which can then be finished by methods ordinarily used for woolen fabrics. Dye types ordinarily used for stock-dyeing the nylon component are Capracyl, Chromacyl, chrome, and selected neutral-dyeing acid dyes. The wool will usually be dyed with chrome colors.

Nylon-wool blends can also be piece-dyed satisfactorily. Milling types are most generally useful. In pale shades, the use of long-chain alkyl sulfates prevents color from transferring from the wool to the nylon, so that the latter does not become more heavily dyed. Success will depend upon the shade, the fabric blend and the construction. Chromacyl colors are particularly useful for dyeing nylon-wool blends that have been carbonized.

Several methods are available for dyeing unions of nylon with cellulosic fibers. The neutral-dyeing Capracyl dyes, as they show little stain on cellulose, can be used in conjunction with fast-to-light direct dyes for the cellulosic fiber. Other methods used in the trade include the following:

(1) Nylon, acetate dyes; cotton, direct dyes

(2) Nylon, neutral-dyeing acid dyes; cotton, direct dyes

(3) Nylon, Capracyl dyes; cotton, vat dyes (two-bath)

(4) Union-dyeing vat colors for covering both the nylon and cellulosic fiber.

DYEING ORLON —— This young debutante of the textile world is currently commercially available as filament and fiberstock. The latter term designates a form of staple made by cutting up by-product filament production. It is also produced now as regular staple on a pilot-plant scale. Regular staple production, which is scheduled to start at the Camden plant in 1952, will have a higher dye affinity than either filament or fiberstock.

Color classes having affinity for Orlon are acid, acetate, basic, vat and some azoic types *(3)*. Acid colors have good to excellent affinity *for staple* when applied at or near a full boil by the copper salt-hydroxylamine technique. At elevated temperatures they can be applied with copper salts and certain reducing agents, such as glyoxal. Filament yarn (type 81) and fiberstock have less affinity for acid dyes applied by the cuprous-ion technique. Consequently, it is necessary to use assistants, such as substituted or unsubstituted phenols, aromatic carboxylic acids, etc. Even with the use of these agents, however, it is necessary that the dyebath boil actively to get good color exhaustion and fixation. Better fixation can be accomplished without these carriers at elevated temperatures near 250° F. Many mills are now equipped for experimental pressure dyeing of rawstock and yarns, and some have progressed to commercial dyeing at elevated temperatures.

When properly applied, acid dyes on filament, fiberstock or staple show good wet fastness, and good fastness to sunlight is possible by proper color selection. Fastness indicated by Fade-Ometer may be misleading, so determination of light fastness by actual sunlight exposure is recommended.

Control of drying time and temperature is important in the dyeing and finishing of Orlon acrylic fiber. In the cuprous-ion process, drying time and temperature are determined by the copper concentration in the dye bath. For example, fiber dyed in the laboratory in a bath containing 4% cuprous ion can be dried at 250° F for a maximum of three minutes. Since it has been determined that the presence of copper accelerates browning, which results from excessive drying time or temperature, it is important that the minimum quantity of copper be used to obtain the desired shade and that time and temperature control compatible with the copper concentration be established in drying. Wool that is to be blended with cuprous-ion-dyed Orlon fiber should be either dyed or acid-treated to prevent color destruction on the Orlon fiber when subjected to dry or moist heat.

Acetate dyes applied to Orlon at 212° F generally produce light shades. At 250° F, however, eight to ten times as much color will be absorbed, so that medium shades are possible. Pressure-dyed acetate colors have a wet fastness about equal to that of vat colors on cotton, and selected dyes show fairly good sunlight fastness. The high-temperature dyeing of Orlon has recently been discussed by Thomas and others *(4)*.

Selected indigoid and thioindigoid vat colors have affinity for Orlon acrylic fiber at 212° F, but at this temperature are "ring-dyers". By increasing the temperature to 250° F, however, excellent yarn penetration and full shades can be obtained. Better color absorption and protection of the fiber against alkaline degradation is obtained by using approximately three parts of sodium bicarbonate per part of caustic soda employed for color reduction. Indigoid and thioindigoid vat dyes on Orlon are outstanding in wet fastness and have light fastness of the order of that on cotton, in the range of 15-30 hours for some shades, while 80-160 hours can be obtained in black shades.

Soluble vat colors can be applied to Orlon by a simple modification of the technique used for cotton, and vat pigments can be applied by a modification

of the Thermosol Process. The light and wet fastness of the light shades so produced are considered by the trade to be adequate for some uses, as for curtains. Basic dyes have fair affinity for Orlon at 212° F, and excellent affinity and wash fastness at 250° F. However, the light fastness is only fair.

A few of the dyes recommended for Orlon acrylic fiber are as follows:

Acetate Dyes

Acetamine Yellow CG
Acetamine Orange GR Conc 175%
Celanthrene Red 3BN Conc
Celanthrene Violet CB
Celanthrene Red Violet R Conc 150%
Celanthrene Pure Blue BRS 400%

Acid Dyes

Du Pont Quinoline Yellow PN Extra Conc
Du Pont Orange II Conc
Pontacyl Fast Red AS Extra Conc
Du Pont Anthraquinone Iris R
Du Pont Anthraquinone Blue SWF Conc 150%

Vat Dyes

Ponsol Golden Yellow GK Double Paste
Sulfanthrene Pink FF Paste
Sulfanthrene Red 3B Paste
Sulfanthrene Blue 2 BD Double Paste
Sulfanthrene Black PR Double Paste

BLENDS WITH ORLON ACRYLIC STAPLE——Good unions in solid shades have been impossible to obtain on blends of Orlon staple and wool. However fairly good tone-in-tone effects can be obtained in some cases. Success depends largely upon the blend and the fabric. However, the Orlon component can be dyed with acid colors or acetate dyes, and the wool can then be cross-dyed after the fabric is knit or woven. It is preferable to pressure-dye the Orlon stock, so that the dyes thereon will have sufficient fastness for mill-processing and the cross-dyeing operation.

Cellulosic blends can be dyed by two-bath methods as follows: 1) After dyeing the Orlon to shade by the cuprous-ion technique, apply direct colors to the cellulosic fiber in a fresh bath at 160-180° F. 2) After vat-dyeing the cellulosic fiber at 160° F or below, apply acid dyes to the Orlon in a fresh bath by the cuprous-ion technique. Reversal of this order of application also appears possible.

DYEING DACRON POLYESTER FIBER——Dacron, the subdebutante Du Pont fiber, which will not reach its commercial "coming-out" stage until 1953, is noted particularly for its bounce and resiliency, and its ability to shed wrinkles. It looks particularly attractive for tropical suitings.

This fiber, which will be commercially available in filament, fiberstock and staple forms, has affinity for fewer color classes than nylon or Orlon acrylic fiber. For practical purposes, only acetate, developed-acetate and certain azoic dyes can be applied. In spite of this, men's-suiting fastness can be obtained by intelligent color selection, which surpasses the fastness properties obtained with metallized colors on wool.

The most versatile color class on Dacron polyester fiber is the acetate dye class. At 212° F certain of these show fairly good affinity, but most show poor penetration. At 250° F, however, full shades can be obtained in normal dyeing times.

As there are only ten to twelve commercial dye houses in the U S equipped for pressure dyeing on a small scale at the moment, most of you will ask, "How can we dye Dacron now without pressure equipment?" The best answer at the moment, outside of the Thermosol and molten-metal processes currently under development, is to resort to the use of carriers to swell the fiber and to permit dye penetration.

The ideal carrier for the dyeing of any fiber should be odorless, nonvolatile, nonflammable, nontoxic, water-soluble, effective in low concentration, have a low cost, and be easily removed at the completion of the dyeing. Volatile, noxious carriers should be used with extreme care so as to avoid harm to mill personnel. Carriers that have been recommended for Dacron or are now on the market have included proprietary formulas based on tetrahydronaphthalene, soaps, mono- and polychlorobenzenes, o-phenylphenol, etc. We have recommended the use of benzoic and salicylic acids for light to medium shades, and ortho or p-phenylphenol for medium to heavy shades.

Our general experience has been that the nonvolatile carriers that remain in the bath completely through the dyeing cycle give better fiber penetration, which results in better wash fastness. The wet fastness of properly applied acetate dyes on Dacron approaches the fastness of vat dyes on cotton.

Our best black on Dacron polyester fiber has been produced with an inexpensive developed acetate black as follows:

1) Application of the base color (5% Acetamine Diazo Black RB Conc 150%) in the presence of a swelling agent at a pH of 6-8 at a full boil over 1½ hours.

2) After a warm running rinse, the bath is dropped, and 2% Acetamine Developer AD Extra is applied over 1 hour at the boil.

3) After a warm rinse, the base and coupling component on the fiber are simultaneously diazotized and coupled by use of

10% sodium nitrite and
15% sulfuric acid, owf.

Diazotization is started at 110° F, the temperature is raised to 200° F (adequate ventilation), and the goods are run for ½ hour.

4) After being rinsed, the material is scoured for ½ hour at a boil with

10% caustic soda and
2% Duponol D Paste

to remove all loose color and carrier.

A number of Du Pont Naphthanil Bases, applied by the same procedure, give excellent wet fastness and 20- to 40-hour light fastness in scarlet, maroon, burgundy and bordeaux shades. These bases can also be applied simultaneously with the developer.

Acetate dyes properly applied to Dacron polyester fiber show excellent fastness to fulling, hot-dry and hot-moist pressing, and decating. Consequently, acetate-dyed Dacron can be safely mill-processed after being blended with dyed wool. In addition, acetate-dyed Dacron can be blended with clean wool, spun into yarn and woven into fabric. Then the wool component can be cross-dyed with acid, Chromacyl or chrome colors without unduly affecting the strength or shade of the dyes on the Dacron or causing color migration to the wool.

Some of the recommended dyes for Dacron are

Acetate Dyes

Celanthrene Fast Yellow GL Conc 300%
Acetamine Yellow CG
Acetamine Orange GR Conc 175%
Acetamine Scarlet B
Celanthrene Red 3BN Conc
Celanthrene Violet BGF
Celanthrene Blue P-23
Acetamine Diazo Black RB Conc 150%

Azoic Dyes

Du Pont Naphthanil Red B Base
Du Pont Naphthanil Red G Base
Du Pont Naphthanil Red 3G Base
Du Pont Naphthanil Scarlet G Base
Du Pont Naphthanil Bordeaux GP Base
Du Pont Naphthanil Garnet GBCH
Acetamine Orange GR Conc 175% (maroon)

BLENDS WITH DACRON POLYESTER FIBER——Blends of Dacron and wool can also be dyed in light and medium shades by a one-bath method in the

(Concluded on Page P82)

Philadelphia Section——

PEROXIDE BLEACHING OF COTTON YARNS AND FABRICS*

T E BELL
Electrochemicals Department
E I du Pont de Nemours & Co, Inc

INTRODUCTION

I AM PLEASED to have this opportunity to talk with you about the peroxide bleaching of cotton yarns and fabrics. Since the major interest of many of the textile mills in the Philadelphia area is the package bleaching of cotton yarns and the bleaching of cotton knit goods, I will attempt to cover these topics in some detail.

To illustrate the most recent developments in bleaching sheeting and piece goods, we will show a film which was made in one of the large southern mills. It shows the details of the du Pont continuous bleaching range and its operation. This should be especially interesting to those of you who are not familiar with a continuous bleaching installation.

In the twenty years that have elapsed since high-strength, high-purity hydrogen peroxide solutions have become commercially available, major advances have been made in the use of peroxide for bleaching cotton in all forms, from raw stock through warp, skein, and package yarns to cotton piece goods and cotton knit goods. The simultaneous development of improved equipment, made from stainless steel, has contributed materially to these advances. It should be pointed out that mill personnel, working in co-operation with the technical personnel of the major peroxide manufacturers, have also made a major contribution in the development of peroxide bleaching methods, and in the general program which is gradually but surely changing textile bleaching from an art to a science.

In 1931 not more than 30% of all the cotton goods bleached were bleached with peroxides; in 1951 more than 65% are bleached by one of the peroxide methods. This percentage includes the volume of goods bleached in the continuous processes that have been developed and brought to commercial success since 1939.

* Presented in Philadelphia on October 26, 1951.

T E Bell

The rapid increase in the use of hydrogen peroxide for bleaching cotton is attributed to the commercial availability of strong, pure hydrogen peroxide and the simultaneous development of improved, stainless-steel equipment. In 1951, over 65% of all cotton goods bleached in this country was bleached by one of the peroxide methods.

The fundamentals of peroxide bleaching of cotton yarns and fabrics are outlined. Basic methods and formulas, which follow the fundamental principles, are given for the bleaching of piece goods, cotton yarns, and knit goods. Typical methods and formulas are given for bleaching cotton yarn in package machines and cotton knit goods in reel machines, kiers, and continuous bleaching ranges. The equipment and operation of the one-stage continuous peroxide bleaching range for handling cotton knit goods are described in detail. This installation has a capacity of about 2500 lb/hr and produces material which compares favorably with the best knit goods produced in batch processes.

BLEACHING COTTON YARNS

FUNDAMENTALS——In selecting a peroxide bleaching method which will be both effective and economically sound, careful attention must be given to those fundamentals that apply to all peroxide methods of bleaching cotton yarns and fabrics:

1) The yarn or fabric must be properly wet out *before* the bleaching chemicals are applied.

2) The wet-out yarn or fabric must be properly saturated with the bleaching chemicals *before* being heated to bleaching temperature.

3) The bleaching solution and the yarn or fabric must be heated quickly and uniformly to the optimum bleaching temperature.

4) The yarn or fabric and the bleaching solution with which it is saturated must be maintained at the optimum bleaching temperature for a sufficient length of time for the bleaching reaction to be completed, or the desired shade reached.

5) The bleached yarn or fabric must be washed thoroughly to remove the by-products of the bleaching reaction and the unreacted chemicals.

There are, of course, an almost infinite number of possible formulas which can be used in the peroxide bleaching of materials made from cotton, and almost every bleacher has his own ideas as to the formula to be used. Since equipment, water supply, and raw materials vary from mill to mill, there is good reason for making minor adjustments in formulas even though the fabrics being bleached and the results desired are, in general, quite similar. In this discussion we will not attempt to cover every possible variable, but will confine our remarks to basic methods and formulas, which can easily be modified by the bleacher to fit his own particular conditions or requirements.

YARN IN PACKAGE MACHINES——The bleaching of cotton yarns wound on packages of various types is a most efficient method of producing white and light-shade yarns for weaving or knitting. The constant increase in the use of package equipment, particularly stainless-steel equipment, indicates the growing importance of this method of handling. Flexible, quick, economical, and effective pro-

cedures have been developed for bleaching yarns in package machines with hydrogen peroxide. We will describe one method which, without changes in the basic procedure, produces bleached yarns suitable for white or for dyeing light shades for either knitting or weaving. This method can be used either to give a complete bleach with hydrogen peroxide or partially to bleach the yarn with peroxide before completion of the bleach with chlorine.

The peroxide bleaching of cotton yarns in a stainless-steel package machine may be carried out as follows:

1) Place the load of yarn in the machine.

2) Fill the machine with the required amount of water and add a suitable wetting agent, usually 1-2%, based on dry weight of fiber (owf). Start up the machine and heat the water to 140°F. Add 1-2% tetrasodium pyrophosphate, owf. Raise the temperature to 180-200°F and circulate for 15 minutes.

3) Drain the wetting-out and scouring solution but do not rinse the yarn.

4) Fill the machine with water at 120°F and add the bleaching chemicals, in the order given, to the water circulating through the expansion tank.

	% owf
Soda ash	3
Sodium silicate, 42° Bé	3
Hydrogen peroxide, 35%	4-6

The soda ash and other dry chemicals should be dissolved in water before they are added to the expansion tank. After the chemicals have been added, circulate the liquor for about 10 minutes.

5) Gradually raise the temperature to 180°F and hold there for ½ hour, then raise the temperature to 190°F and hold for one hour. Raise the temperature again to 200°F and hold for one more hour, at which time the maximum amount of bleaching should have taken place. Drain the machine.

Generally speaking, the formula given above with 4% of hydrogen peroxide will give a satisfactory color for dyeing light shades and, on some high-grade yarns, a satisfactory color for tinting white.

For materials that are treated only with peroxide, rinse the yarn free from alkali after bleaching has been completed. This usually requires 3 or 4 rinses, first with hot water and gradually with cooler water to about 100°F before addition of bluing or of a fluorescent tint.

When the peroxide step is used to prepare the yarn for subsequent chlorine bleaching to a full white, the bluing operation is omitted, and the second, or chlorine stage, is carried out as follows:

1) Fill the machine with water at 100°F and add 3% of sodium silicate and 3-6% of sodium hypochlorite containing 15% available chlorine, percentages being based on dry weight of fiber.

2) Raise the temperature of the bleach bath to 110°F and bleach for about 30 minutes.

3) Drain the solution and wash the yarn thoroughly.

4) Add an antichlor, consisting of ½% of sodium bisulfite owf, to destroy any unreacted sodium hypochlorite.

5) Wash the yarn thoroughly with fresh water and add blue or fluorescent tint.

In most cases a satisfactory bleach can be obtained with only the first, or peroxide, bleaching step. In bleaching carded yarns or yarns made from inferior or highly-colored cottons in the one-step process, it is sometimes necessary to increase the peroxide concentration to 6%, and even to 8%. When yarns contain Egyptian cotton or very low-grade American cotton, the two steps are usually required. The two-step process may also be used for bleaching linen yarns since the chlorine treatment is helpful in removing the woody fibers usually present in linens.

BLEACHING COTTON KNIT GOODS

Cotton knit goods are usually bleached in one of three types of equipment: 1) the standard reel machine or dyetub, 2) the kier, or 3) the continuous bleaching range. The bleaching formulas used and the method of operation varies with the equipment available. Typical methods for bleaching in each type of equipment are as follows:

REEL MACHINES OR DYETUBS——The method described includes two steps: first, a bleach with either sodium peroxide or hydrogen peroxide, and a second bleach with sodium hypochlorite. The peroxide step is used to prepare fabrics for the dyeing of light shades. In some cases, with careful selection of dyestuffs, the dyeing operation can be carried out right in the bleach bath. This peroxide bleach also prepares the fabric for the second step, the hypochlorite bleach. The process is carried out in the following manner:

1) Fill the machine with the minimum amount of water that permits satisfactory operation. This is usually 600 gallons for 1000 pounds of cloth.

2) Load the cloth in the machine with about 3 rolls, or 100 pounds, in each compartment and add 1-2% of wetting agent owf. The batch usually totals approximately 1000 pounds.

3) With the machine running slowly, add either 30 pounds of sodium peroxide, or 30 pounds of caustic soda and 30 pounds of 35% hydrogen peroxide, to the front of the machine in such a manner that no undissolved material comes in contact with the fabric.

4) Run the cloth cold for 15 minutes until the fabric is thoroughly saturated with the chemicals, then raise the temperature to 180°F, and run for one hour. Raise the temperature again to 200°F and run for one-half hour.

5) Drain the tub and wash the cloth thoroughly; usually three rinses are sufficient.

6) Again fill the machine with water at 100°F and add 20-30 pounds of sodium silicate and 25-50 pounds of 15% sodium hypochlorite, to the front of the machine while it is turning. The exact amount of chemicals required depends upon the degree of whiteness desired, the fabric weight, and the quality of yarn. Run the cloth cold for 15 minutes, or until the chemicals are evenly distributed throughout the fabric. Raise the temperature to 120°F and bleach the cloth for another half hour.

7) Next raise the temperature to 150°F and add 10-20 pounds of sodium bisulfite. Run the cloth for ½ hour and drain the machine.

8) Fill the machine with fresh water and rinse the cloth thoroughly. Drain and refill the machine and then add blue, fluorescent tint, or softener as required.

KIER BLEACHING WITH PEROXIDE——Kier equipment usually consists of an iron pump and heater kier, 8′ x 10′ in dimensions, having a capacity of about 4500 pounds of cotton knit fabric. The pump should have a capacity of 250 gallons per minute against a 40′ head since rapid circulation of the bleach solution is important. Either an outside tubular heat exchanger or a closed coil located below the grates in the well of the kier may be used to heat the circulating solution and, through it, the fabric. The outside heater, which should be large enough to heat 1000 gallons of water from 50 to 200°F in one hour, is preferred.

In addition to the kier proper, it is necessary to have a 2000-gallon mixing tank, which may be made of wood, concrete or stainless steel, equipped with a standard high-speed portable mixer. The shaft and propellers of the mixer should be of stainless steel.

It is also necessary to have equipment for wetting out the fabric before it is loaded into the kier and for washing the fabric after bleaching. This equipment may be either standard slack washers, with their limited speed, or a specially designed straight-line washer, which consists of a series of small washers equipped with squeeze rolls to pull the fabric into the washer and to remove it later. These

small washers are run slack with 60 to 100 yards of cloth in each one. The steps in kier bleaching with peroxide are as follows:

1) Assemble the cloth into one continuous length by either sewing or tying the ends of the rolls together.

2) Fill the wet-out unit (slack washer or straight-line washer) with the proper quantity of water and add about half (20 pounds) of the wetting agent. The balance is added gradually over the entire run.

3) Wet out the fabric by running it continuously through the washer. It is customary to wet out the cloth and to load the kier simultaneously. The cloth is piled in the kier from the top. It is undesirable for a man to get in the kier while piling since this packs the cloth too hard and obstructs circulation.

4) If the kier has been filled with 4500 pounds of fabric, the bleach solution is prepared with the following chemicals added in the order given:

In 1800 gallons of water at 90°F

	lb
Sodium silicate	135
Soda ash	45
Trisodium phosphate	23
Sodium peroxide	23
Hydrogen peroxide, 35%	113
Kier assistant	23

5) When all of the chemicals are thoroughly dissolved, test the solution for total alkali by titration with N/25 sulfuric acid in the presence of phenol red indicator. The peroxide concentration should be determined by titration with a solution of potassium permanganate.

6) After tests indicate that the bath has been properly prepared, run the bleach solution into the kier by gravity through the bottom. It should not be pumped into the kier. After the kier is charged, start the pump and circulate the solution cold for ½ to 1 hour to distribute the chemicals uniformly throughout the goods.

7) After the preliminary circulation, turn on the steam and gradually raise the temperature to 180° F. This temperature rise must take place in not less than 2 hours nor more than 3 hours, 2½ hours being the ideal time. Continue bleaching at 180° F for 5-6 hours, or until a satisfactory color is obtained.

Titrations should be made when the kier reaches operating temperature to make sure that the bleach bath is behaving properly. Tests should also be made to make sure that some peroxide remains until the end of the bleaching period. It is not desirable to continue the bleaching operation after the peroxide has been exhausted. The bleaching period should never exceed 8 hours after the bath reaches operating temperature. Overbleaching results in excessive weight losses and harshness of fabric.

8) When bleaching is complete, drain the charge for one hour, fill the kier with warm water, and circulate for one hour.

9) Drain and repeat the warm-water wash.

10) Drain and wash with cold water.

11) Unload the kier by pulling the cloth through water in the washer. Apply bluing or softener if desired.

CONTINUOUS BLEACHING——Late in 1939 the bleaching industry was startled by the announcement that a successful process for the continuous peroxide bleaching of cotton cloth had been developed. As usual, there were as many skeptics as there were enthusiasts. Subsequent events have proved that the enthusiasts were right and the skeptics wrong. At the present date more than 65% of all the cotton piece goods bleached in the United States is processed through continuous-peroxide-bleaching equipment.

The development and commercial acceptance of continuous peroxide-bleaching processes for cotton piece goods naturally led to an investigation of the feasibility of extending these successful processes to knit goods. With knit goods, however, the problem was quite different because of the different fabric construction and the different requirements of the finished goods.

Two major problems were faced and successfully solved in adapting the continuous peroxide process to knit goods. They were the development of equipment that would handle the fabric continuously without excessive stretching and the development of bleaching solutions that would give the desired whiteness, eliminate motes and shives, and not reduce the fabric weight excessively.

The continuous system used for piece goods, which includes two J boxes, the first for a caustic scour, and the second for a peroxide bleach, was found unsatisfactory for cotton knit goods because the mechanical treatment was too severe and the chemical treatment was excessive. A good white was obtained, but the finished fabric was harsh and unattractive. Steps were then taken to eliminate these defects by making the following changes:

1) The system was reduced to a one-J-box range, and the heavy-piece-goods washers were replaced with light-knit-goods washers to reduce the stretch.

2) The bleaching formula was revised so that the fabric could be scoured and bleached in one bath. This eliminated the caustic scour responsible for weight losses and harshness.

Based upon our experience with the batch bleaching of cotton knit goods, and the continuous bleaching of piece goods, we designed and built a range which contained the following basic equipment:

1) A unit to wet out the grey knit goods.

2) A washer to remove miscellaneous dirt and further wet the fabric.

3) A saturator to impregnate the fabric with bleaching solution.

4) A mix tank for preparing the bleach solution and feeding it continuously to the saturator.

5) A heater-tube unit to raise the cloth temperature from 90 to about 200°F during continuous operation.

6) A J box, containing a piling mechanism, to store the heated cloth one hour while operating continuously.

7) A 3-compartment washer to wash the fabric free from solubilized impurities and unreacted chemicals.

8) A saturator in which to apply finish or tint.

9) A heavy set of squeeze rolls to reduce the moisture content of the fabric below 80% before drying.

The basic equipment for this process as presently operated costs approximately $50,000.00 and produces about 2500 pounds an hour of cotton knit goods averaging four yards a pound in weight. Smaller equipment can be designed and built to handle as little as 500 pounds an hour; below this figure continuous processing becomes uneconomical.

The chemicals used in this process are common, readily available products. They include 1) a good wetting agent, resistant to alkaline peroxide and to temperatures above 200°F, 2) hydrogen peroxide (35 or 50%), 3) silicate of soda, 42° Bé, water white, 4) caustic soda (flake, 100%, or liquid, 50%), 5) softeners, finishes, and tinting materials, such as blue or fluorescent dyestuffs.

The quantities of chemicals used vary, of course, with the weight of the fabric and the quality of the cotton, as well as with the whiteness required.

A good average formula is as follows:

Per 100 Gallons Water

	lb
Sodium silicate	35
Caustic soda, 100%	15
Hydrogen peroxide, 35%	100
Fluorescent dye	3/16 to 5/16

This solution is fed to the saturator at a rate which maintains a 3.75-volume concentration of hydrogen peroxide in the saturator at all times. Approximately 2500 pounds of four-yard knit goods can be bleached with 100 gallons of this solution for a chemical cost of about $1.00 per 100 pounds, excluding the cost of wetting agent and finishing compounds. This compares favorably with conventional kier or reel machine bleaching processes.

Such a system can be operated by two men, exclusive of labor required for assembling, tying or sewing the pieces to-

gether. Production per man is high, about 1250 pounds per hour.

The steam required to operate the J box is only a fraction of that required in the machine or tub bleaching processes. Production of 2500 pounds an hour requires less than 1000 pounds per hour of steam to operate the J box. This does not include the steam required for heating wetting-out and washing liquors, which varies considerably with each installation.

An installation such as this operates at 150 yards per minute on 4-yard goods with less than 50 horsepower. In terms of kilowatt hours of electricity required, the continuous process uses about 35 as compared with about 50 for an equivalent kier process, a saving of about 40%.

Water requirements do not exceed those of conventional batch processes and are frequently as much as 40% lower than kier processes.

The steps of a typical bleaching procedure for a 4-yard carded fabric are as follows:

PREPARATION OF STOCK SOLUTION

For each 100 gallons of water, add 100 pounds of 35% hydrogen peroxide, 35 pounds of sodium silicate, and 15 pounds of caustic-soda flakes. It may also contain 3-5 ounces of fluorescent dye if desired.

WETTING OUT

The cloth, which has previously been sewed or tied into one continuous length, is fed into the wet-out unit by an overhead reel. The wet-out bath should have a temperature of 90-100°F and contain about 2% of a sulfonated pine oil or other good wetting agent, owf.

SATURATION

The cloth is next saturated with a bleach solution prepared by running 50 gallons of solution from the stock tank into 150 gallons of water to provide a 3.75-volume-hydrogen-peroxide bath in the 200-gallon saturator. The saturated cloth is squeezed to a liquid content of 110 ± 5%.

HEATING AND STORAGE

The saturated cloth is passed rapidly (150 ypm) through the heater tube, where its temperature is raised above 200°F, and then into the J box, where it is piled in a geometric pattern, and stored for 1 to 1½ hours. Bleaching takes place during this storage period.

After bleaching, the cloth is thoroughly washed in a 3-compartment straight-line washer. This removes all reaction by-products and unreacted chemicals.

The cloth then passes through a final saturator where softener, and additional finish or bluing may be applied if desired.

Excess water is removed from the bleached fabric by either squeeze rolls or extractors. For efficient drying and to prevent harshness in the finished fabric, it is desirable to reduce the moisture content below 80%.

A number of continuous peroxide bleach systems for cotton knit goods employing the du Pont heating principle and J box have been installed and are in successful operation. Production per unit runs as high as 100,000 pounds per week and can be increased when necessary. The fine fabric produced is commercially acceptable and compares favorably with the best materials processed in batch bleaching processes.

In conclusion, I would like to show you a film which illustrates the continuous bleach process for cotton piece goods. This film was made at a large mill, which produces high grade sheets and piece goods. It is the first bleachery built entirely around continuous peroxide bleaching and continuous dyeing processes, and was put into operation just after the close of the war. I will be happy to answer any questions you wish to ask after you have seen the continuous peroxide bleaching range in operation.

Dyeing of Nylon, etc——

(Concluded from Page P78)

presence of benzoic acid as a carrier with acetate dyes that show little staining on wool and with Chromacyl dyes for the wool. While men's-suiting fastness can be obtained by this process, care must be exercised to prevent mottled effects on the fabric from the agglomeration of acetate dyes, which leads to poor crock fastness. Selected heavy shades can also be dyed by application of acetate dyes to the Dacron, followed by dolly-washing and cross-dyeing the wool with Chromacyl dyes.

Blends of Dacron and cellulosic fibers are best dyed by a two-bath process in which the Dacron is dyed first, followed by scouring to remove carrier and final application of direct or vat colors on the cellulosic fiber.

You will have noted that up to the present we have spoken only in general terms about dyeing at a boil, or at temperatures up to 250-260° F under pressure. Little mention has been made of the Du Pont Thermosol or pad-steam processes or of the hot-oil and molten-metal processes developed by other concerns. We feel sure that each of these dyeing procedures will contribute substantially to advancement in synthetic-fiber dyeing. In addition, new dyes being developed specifically for these fibers will give better dyeability and fastness properties.

In conclusion, we predict that man-made fibers will, in the very near future, contribute immeasureably more to the comfort and well-being of man than they have in the past thirty years. In addition, it is our hope that this talk today will aid to enlist your support and enthusiasm for the further advancements which the synthetic-fiber industry will bring to the textile trades.

REFERENCES

(1) Grove, Vodonik and Casey, *Ind Eng Chem* 43 2235 (1951, No 10).
(2) C E N Staff Report, *Chem Eng News* 29 2552 (June 25, 1951).
(3) Thomas, R J and Meunier, P L, *Am Dyestuff Reptr* 38 P925 (1949).
(4) Lyle, C G, Iannarone, J J, and Thomas, R J, *Am Dyestuff Reptr* 40 P585 (1951).

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1952 Meeting Program—South Central Section

THE program for 1952, as announced by R W Freeze, secretary of the South Central Section, is as follows:

Meetings: February 16—Patten Hotel, Chattanooga, Tennessee
May 17—Patten Hotel, Chattanooga, Tennessee
December 6 — Patten Hotel, Chattanooga, Tennessee

The Summer Outing will be August 22 through August 23, Chattanooga Golf and Country Club.

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M G Morris to Address Mid-West Section at Winter Meeting

MERRILL G MORRIS, National Aniline Division, Allied Chemical & Dye Corporation, will speak at the afternoon session of the Mid-West Section's Winter Meeting at the Bismarck Hotel, Chicago, on Feb 16. His topic will be "The Dyeing of Material for Plain and Face Automobile Fabrics". Mr. Morris, a Lowell Textile Institute graduate, has had 20 years of practical experience in woolen mills and in demonstration work.

Following dinner and the Section's business meeting, a 25-minute film, "The Story of Du Pont Research", will be shown.

ONE HUNDRED AND SEVENTY-NINTH COUNCIL MEETING

THE Council held its 179th meeting in the Hotel New Yorker, New York, N Y, on Friday morning, November 16, 1951. Present were President C Norris Rabold, presiding; J Robert Bonnar and George O Linberg, vice presidents; Albert E Sampson, assistant treasurer; Leonard S Little, chairman of the Research Committee; William D Appel, Carl Z Draves and P J Wood, past prseidents; John M Gould representing Northern New England; Edward J Allard, Raymond W Jacoby, Alden D Nute and James A Stevenson representing Rhode Island; J Edward Lynn representing Western New England; Carl H Brubaker, Charles W Dorn, Herman E Hager, Paul J Luck and Henry L Young representing New York; Morton H Klein, Richard B Stehle, Percival Theel, Frederick V Traut, S Graeme Turnbull and Jackson A Woodruff representing Philadelphia; Kenneth S Campbell representing Piedmont; Kenneth H Barnard of the Convention Committee; William A Holst of the Technical Program Committee; George H Schuler and Glenn D Jackson, Jr of the Publicity Committee; Harold W Stiegler, research director; and H C Chapin, secretary.

The Secretary's report of the 178th Council meeting, the financial report of October 31 and the treasurer's report of November 2 were accepted. John N Dalton and Elmer E Fickett were appointed to serve with the secretary as election tellers.

The following substitution for Article IV, Section 10 of the Bylaws was passed to letter ballot and subsequently adopted.

"The Committee on Conventions shall consist of a chairman appointed by the Council for a term of four years, and eight other senior members of the Association appointed by the Council for such term, not exceeding five years, as will permit, every second year, four appointments for terms of four years each. In the group of eight other than the chairman, representation of the four regions designated in the Bylaws shall be as nearly equal as is possible without resignation of members already appointed. No member, including the chairman, shall serve more than five years consecutively.

"Except for technical programs, this committee shall be responsible for all management of conventions, with cooperation of sections acting as hosts of conventions. The Committee shall appoint its own treasurer, collect all fees, pay all bills and keep its own accounts, subject to audit by the Council. The treasurer may, or may not, be one of the committee members appointed by the Council. He shall be bonded in an amount considered proper by the Council.

"For the management of each convention, this committee shall be allowed, from the General Fund of the Association, an appropriation of one thousand dollars, repayment of which shall be a debt of that convention. The Committee may engage salaried personnel or sign contracts in the name of the Association within the limits of this one thousand dollars per convention, but beyond this only to the extent authorized by specific vote of the Council. Within six months following each convention, the committee shall render a financial report to the treasurer of the Association, and shall remit to him any balance of funds in the accounts of said convention. The treasurer of the Association shall then pay to the section or sections designated by the Council as hosts for that convention any surplus of receipts over expenditures therefrom up to and including the first one thousand dollars, plus ten percent of any amount above that one thousand dollars. The residue shall remain in a part of the General Fund of the Association designated as a Convention Fund until otherwise appropriated by the Council."

Representing the President's Advisory Committee, Mr Bonnar presented a report outlining a plan for a business manager to be located in New York. After discussion it was voted that this be mailed to every member of the Council, with request that he obtain local opinions thereon, and report at the next Council meeting.

Professor Theel reported progress on the Vat Dye monograph nearly to the submission of manuscript to publishers for bids. All papers presented before sections up to the date of the convention had been edited for publication. Descriptions of tests in the *Year Book* were being revised to standard forms, in collaboration with societies employing similar tests. Mr Sampson reported agreement with the Society of Dyers and Colourists on the type of paper to be purchased in this country for the *Colour Index*. It was voted accordingly that the Chairman of the Publications Committee be authorized to place a contract for paper in anticipation of such needs, in amount not to exceed $30,000. Shipment of this paper to England is to follow signing of the Colour Index contract.

Mr Little reported progress on proposals for compromise standards, to be completed by December 15th in preparation for the International Standards Organization meeting of next June in New York. Mr Seibert was preparing an in-

SECRETARY'S FINANCIAL REPORT—OCTOBER 31, 1951

	Applications	*Dues, regular & reinstate*	*Dues, Corporate & Sustaining*	*Miscellaneous*	*Totals*
Received and transmitted to Treasurer,					
August 1 to October 5, 1951	$ 693.50	$ 132.00	$ 500.00	$2,750.99	$ 4,076.49
October 5 to 31, 1951	488.50	18,980.00	572.50	1,267.67*	21,308.67
Total in fiscal year to October 31	1,182.00	19,112.00	1,072.50	4,018.66	25,385.16
Leaving deposited by Treasurer with Secretary					3,701.53
Miscellaneous items					*
Dividends					$ 209.90
Reporters and reprints					5.80
Year books					447.10
Crockmeters					82.87
Crock cloth					87.75
Moth cloth					18.75
Water test apparatus					12.70
Dyed standards					12.00
Knitted tubing					.80
Gas fading units					1.00
Buttons					6.00
Color transfer chart					2.50
Flammability apparatus blueprint					1.00
Colour Index					30.00
Analytical Methods					349.50
					$1,267.67

H C CHAPIN,
Secretary

terim report on his recent light fastness work, for circulation to the Research Committee and corporate members. A committee on bleaching was to be organized.

Mr Linberg reported for the committees on Corporate Membership and Membership and Local Sections. Renfro Hosiery Mills Company was elected to Corporate membership. Each of the following was elected to the class of membership specified, as of thirty days from publication of application, provided no objection be received meanwhile by the secretary.

SENIOR

Adamowicz, W C
Adams, F H
Allan, T T
Atwood, J O
Baggett, J L
Bono, J A
Channon, H B
Chromey, F C
Cimino, N J
Conroy, H E
Cornthwaite, W R
Corrozi, M A
Coven, G E
Crowley, J C
Eldridge, J R
Estell, H S
Evans, S R
Fineman, M N
Fisher, D
Forster, W S
Garlington, V H
Goetz, A F
Hall, I L
Hardy, W B
Harrison, J W
Hasegawa, T
Hilson, F F
Iacobacci, J W
Kaneko, H
Kazenas, Z
Kourtz, R E
Langley, W M
Leach, H M
LeGuillou, J
Lehman, C E H
Littlefield, J C
Long, R S
Luthy, J W
Mark, H
McCarthy, J F
Mersereau, E P Jr
Minella, L
Monk, G B
Morison, C R W
Nirenberg, R P
Oertel, G J
Patt, D H
Ralph, W M
Raposy, L
Rhael, E W
Rippner, F C
Roberts, R R
Rusin, C E
Sawyer, H M
Schroeder, C W
Scott, P J
Siddons, A B
Simpson, K M
Smith, H J
Suzuki, G
Szlosberg, E
Tigert, A J
Vess, F W
Vitkinas, J L
Wagner, R
Walb, T A
Walker, A H
Warshaw, E C
Watanabe, S
Wicks, Z W
Zeil, H G Jr

JUNIOR

Alexander, E N
Alexander, M R
Ciesla, E T
Entner, A
Golovatchoff, A
Goodwin, R F
Hill, E M
Horne, C M
Johnson, R D
Kale, T L
Kennedy, D M
McMackin, L V Jr
Merrill, A R
Parsons, S T Jr
Perrin, A L
Reilly, T J Jr
Rusher, J L Jr
Smith, H R
Tiedemann, C H
Wagandt, C L
Walker, H P Jr
Wilkerson, V F Jr
Wirth, A R

ASSOCIATE

Baria, R R
Barrett, R C
Bischoff, C A
Clark, R T
Collins, G W
Dowdee, I L
Geib, W D
Graham, W W
Lacovara, D E
Levenson, J J Jr
MacKnight, H A
Mahan, T A
Markley, M C
Newcomb, W J
Poole, W H
Rittenhouse, G V
Schwartz, C W 4th
Shaftan, L
Strickel, W R
Swanson, C E
Tatro, J A
Thorn, H Z
Williamson, J S

STUDENT

Belanger, W E
Blandin, S W
Buchanan, W C Jr
Carr, W W
Clarke, F J
Croker, B M
Denemark, M R
Dooley, D D
Finnie, T A
Giard, E H
Gortari, D
Gropper, S W
Hand, F F
Holloway, B G
Holton, E G
Kelley, R J
Latimer, J L
Lawler, J
Libbey, A J Jr
Liu, A T
Merkel, R S
Middleton, H L
Nelson, C D
Nelson, E
Owens, E D
Parekh, S
Pelton, W J
Protis, R L
Smith, B E
Smith, C D
Thibodeau, W N
Tournas, A
Velantzas, J A
Wechsler, H
Weiss, G M
Wellborn, C D Jr
Whitfield, F C
Williams, C L Jr
Young, R C
Zavaglia, E A
Zeldis, L

The following were transferred from other classifications to Senior Membership:

Alpert, M
Anderson, A C
Christopher, V J
Dargie, P N
Flanagan, W J
Getsinger, C F
Gibson, J W Jr
Gleadall, W W
Hayek, M
Jedeikin, R A
MacLean, P E
DelSanto, A A
McCann, W H
McKone, P J Jr
Robbins, T F
Squier, R C
Walwood, J T

Respectfully submitted,

H C CHAPIN,
Secretary

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R I Section to Meet Feb 29th

THE next meeting of the Rhode Island Section will be held at Johnson's Grille, Providence, R I, on February 29th at 8 pm. An informal dinner at 6 will precede the business and technical session.

Additional meeting dates for 1952 have been arranged as follows:

March 28 — Providence Engineering Society
April 25—Wannamoisett Country Club
May 23—Providence Engineering Society
June 6—Annual Outing, Wannamoisett Country Club
October 24 — Providence Engineering Society
December 5 — Annual Meeting and Election of Officers, Sheraton-Biltmore.

EMPLOYMENT REGISTER

This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Lowell Textile Institute, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.

52-1

Education: BS, Bradford Durfee Technical Institute.
Experience: laboratory and drug room.
Age: 25; married; references; position in piece dye house, New York or New Jersey, preferred.

52-2

Education: BS in chemistry, with graduate study.
Experience: textile research and plant development, project leader.
Age: 33; married; references; position in technical sales, vicinity of New York, preferred.

52-3

Education: AB in physics, with graduate work in chemistry, physics and metallurgy.
Experience: 20 years developing markets for chemical specialties, especially surface-active agents.
Age: 43; married; references.

52-4

Education: BTC, Lowell Textile Institute.
Experience: laboratory colorist and textile chemist, wool, nylon and mixed fibers.
Age: 37, married; references; any location in U S acceptable.

LAPEL BUTTONS FOR MEMBERS

These buttons bear the seal of the AATCC and may be purchased by members in good standing from the National Secretary at $2.00 each.

DR HAROLD C CHAPIN
Lowell Textile Institute
Lowell, Massachusetts

• PATENT DIGEST •

PAUL WENGRAF

BEETLE CALENDER—— Beating Process by Electrochemical Vibration G, 4

U S Pat 2,566,075
(Bleacher's Assn Ltd, Lockers Ltd——Taylor, Melville——Aug 28, 1951)

The old process of beetling (Lancashire Beetle) is characterized by an arrangement of a large number of hard wooden hammers that fall onto a beam of cloth. Other constructions provide metallic hammers instead of the wooden "fallers". The metallic type machine is operated by an overhead cam, providing as much as 400 blows per minute and thereby increasing considerably the beating effect as compared with the wooden construction. This device is known as High Speed Spring Beetle.

The present invention provides a further increase in the beating effect by causing one or more beaters to beat the fabric from 600 to 1000 times per minute. This increase in frequency has been made possible by means of electromechanical vibrations. The distance between the beaters and the fabrics to be treated is quite small; it may be between 1/16 and ⅛ of an inch.

The beetle calender contains an electromagnetic assembly (13), supported by pillars (14) fixed to frame (15), which is vertically displaceable in guides (16) (see Fig 1). Frame (15) and attached parts can be lifted by an arrangement of pulleys and wheels, operated by hand wheel (28).

Fig 2 indicates the construction of the beetling mechanism. It consists of armature (29)—more visible in Fig. 1—rigidly connected with a center member (31) in which a hard wooden member (32) is inserted. Energization of the electromagnet assembly (13) is controlled by panel (33). Modifications of this device provide a continuous treatment of the fabric as it passes between rotatable rollers on an arrangement of rollers that guides the fabric and multiplies the speed of the beating effect by transmitting the impact from one layer of fabric to the other.

Advantages of the new construction are: reduction in size and weight of customary beetle machinery, a considerable increase in the beating effect, use of one beating element instead of a greater number of fallers or hammers, and the possibility of varying the intensity of the blows by adjusting the electrical control.

Among references cited by the Patent Office:

U S P 1,442,840 (Bradford Dyers Assn /1923): uniformity of beetling is attained by a roller arrangement that works on a beam consisting of alternate layers of the fabric and sheets of yielding material, such as rubber.

U S P 1,095,901 (Marsden, Jervis/ 1914): hammers in a beetling machine are driven toward the beetling roller and withdrawn by the action of a compressing fluid on pistons attached to the individual hammers.

U S P 1,090,590 (Arnfield, Booth/ 1914): a beetle machine comprises a sliding or movable outside cylinder in connection with each beetle hammer head. On the descent of the outside sliding cylinder, the hammer falls away from the beam by suction and gravity.

Brit P 2,079 (1910), a single faller is worked by eccentrics to give rapid blows to the fabric placed on a beam, which is revolved by the action of the faller.

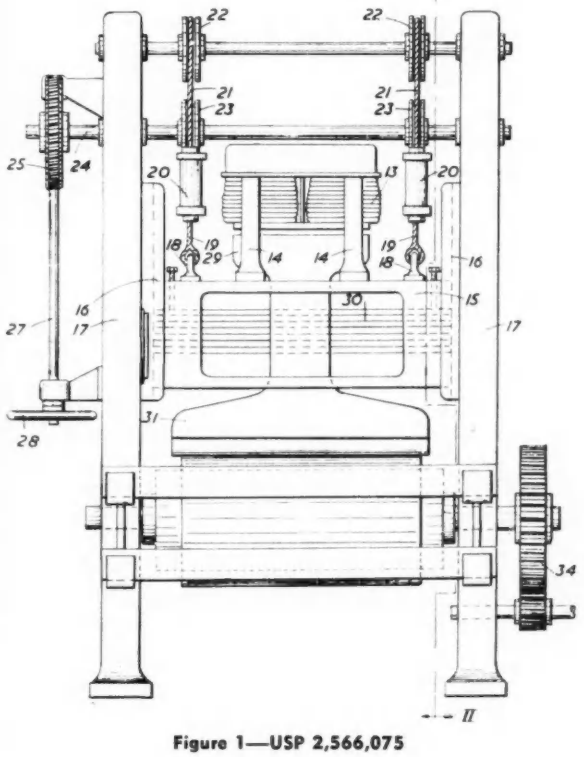

Figure 1—USP 2,566,075

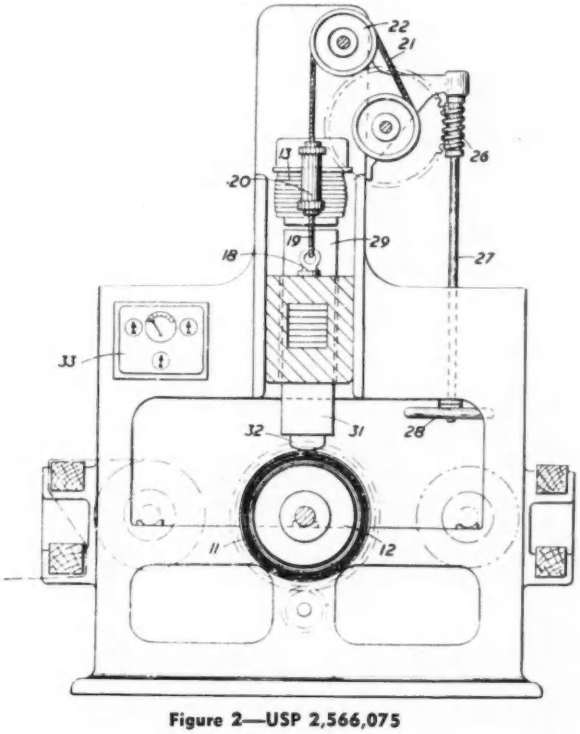

Figure 2—USP 2,566,075

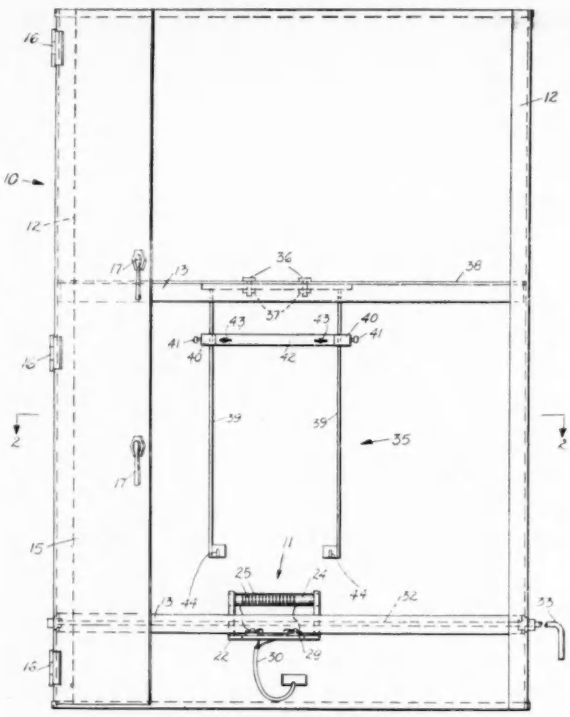

Figure 1—USP 2,566,338

APPARATUS for Testing Fire Resistance H2, 02

U S P 2,566,338
(H B Kime——Sept 4, 1951)

The purpose of this apparatus is to test the fire resistance of flameproofed material under controllable, reproducible conditions, avoiding variations of temperature by replacing the usual gas burners by an electrically heated coil.

Figure 1 shows the apparatus in a closed chamber. Door (15) placed on the left hand side of the device can be opened to introduce the specimen, which is fixed on holder (35) by means of hooks (44) and clamping bar (40). When the door is closed, the electric heater (11) can be moved from the outside by handle (33) and rod (32) until it is in vertical registration with specimen holder (35). Base (22) is insulated from its supporting bar (13) and connected by cable (30) with a source of electricity. The results can be observed through a window secured in front of the apparatus (not shown in this drawing).

Among references cited by the Patent Office:

U S P 2,316,378 (Gurley/1943): an apparatus for determining the curling properties of paper, comprising a closed electrically-heated chamber having a translucent side wall whereby the curling angle of a sheet of paper to be tested can be observed.

U S P 1,759,799 (Nickerl/1930): an incubator containing electrically-heated members arranged rotatably around the incubator trays.

CREASEPROOFING TEXTILES——Combining Thiophene- and Phenol-Formaldehyde Resins G, 2, 04

U S P 2,569,695
(Socony Vacuum Oil Co——Schick, Hartough——Oct 2, 1951)

The preamble of this specification includes many references to the manufacture and application of nitrogenous, i e, ammonium, salts or amine salts containing phenol-formaldehyde condensates and, on the other hand, thiophene-formaldehyde condensates containing ammonium or hydroxylamine salts. The latter method has been described and filed in a copending application by the same inventors.

It has been discovered that both methods (i e, application of phenolic and heterocyclic resins, such as thiophene-, furane- or pyrrhol-condensates) can be combined to give an improved crushproofing effect on textiles. The treatment is carried out in two steps. First, the goods are impregnated with the nitrogenous phenol-aldehyde precondensate in water soluble or water dispersible form. After curing, a second impregnation with the heterocyclic compound-aldehyde precondensate follows whereupon the material is cured again. In a modification of this process the curing operation that would follow the first impregnation is omitted and effected after the second impregnation only.

Example: A sample of cotton poplin is prepared with phenol, formaldehyde and ammonium chloride, and sodium bisulfite, after which it is squeezed and immersed in a fresh 12% aqueous formaldehyde solution. After removal of the excess formaldehyde the material is cured at 115-120° C, impregnated with a thiophene-formaldehyde-ammonium chloride solution, mixed with sodium bisulfite and treated with aqueous sodium acetate, which apparently insolubilizes the thiophene condensate. It is immersed thereafter in alkaline formaldehyde solution and cured again. Textiles so treated are reported not only crush resistant but also water repellent (spray-rating over 90).

Reference cited by the Patent Office:

U S P 2,114,121 (Bakelite Corp/1938): a brake lining fabric comprising a frictional substance of resinous character mixed with a condensate of formaldehyde and an alkene phenol. *(Example:* a condensate of a phenol-cresol mixture reacted with tung oil and hexamethylene tetramine).

Reference is further made to:

U S P 2,559,250 (Socony Vacuum): nitrogenous resins containing thiophene or other heterocyclic compounds are used for imparting water-repellency to cotton (possibly corresponding to the co-pending application mentioned above).

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FINISHING TEXTILES—— Cold Swelling Starch Containing Melamine-Aldehyde G, 2, 01

U S Pat 2,562,558
(W A Scholtens, Chem Fabr——Lolkema, Van der Meer——July 31, 1951)

Cold-water-soluble starch can be prepared by heating a mixture of raw starch, an aldehyde and water in a rotatory drum at elevated temperatures, thereafter evaporating excess water and pressing the remaining paste to a thin layer that is finally dried and reduced to a fine powder (U S Pat 2,246,635/1941).

According to the present invention a similar process for manufacturing cold-water-soluble starch consists of heating cold-swelling starch for a short time with formaldehyde and melamine. In the absence of an acid catalyst no substantial resinification occurs. Moreover, any reaction of the components is inhibited be-

cause the starch suspension acts as an "embedding" medium. The acid catalyst may be added shortly before use or ev n incorporated in this suspension, provided a potentially acid catalyst liberating acid at higher temperatures is applied.

The solutions prepared this way from cold-water-soluble starch (as indicated in U S Pat 2,246,635) and mixed with an aqueous melamine-formaldehyde solution as well as an acid thickened with starch can be used as sizing or finishing agents. Textiles impregnated with a composition of this type contain the insolubilized resin as a finely-dispersed binder thus making the finish durable. A special advantage is that this finish dissolves readily in cold water in contrast to other starch finishes that have to be boiled first and then cooled before use.

Example: A melamine-formaldehyde precondensate (condensed at pH 8 for 10-15 min on the steam bath) is mixed with a raw starch suspension. The whole mixture is then converted into cold-water-soluble starch by heating in a drum.

Among references cited by the Patent Office:

U S Pat 2,408,065 (Staley Manufacturing Co/1946): a moldable powder prepared from a commercial melamine resin ("Melmac S-77-V"), dissolved in water, mixed with raw starch, dried and ground.

U S Pat 2,400,820 (Rohm & Haas/1946): a stable, modified starch paste prepared from a starch suspension and reacted with a urea-formaldehyde precondensate. (The claims also mention melamine condensates, cf *Am Dyestuff Reptr 35,* 440, 1946).

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Brit P 527,704 (Henkel & Co/1940): an adhesive for gluing wood is prepared by dissolving melamine and formaldehyde in alcohol, evaporating this solution and adding it to a cold-water-soluble starch conversion product, such as a mixture of dextrine and cold-swelling starch.

SHRINKPROOFING WOOL——Hard Drying Oils in Solution or Dispersion A, 2, 04

U S Pat 2,562,603
(Coe, Jr——July 31, 1951)

The shrinkage of wool during washing is supposed to be caused mainly by interlocking of the scales of the individual wool fibers. According to the preamble of this specification, shrinkproofing processes, in general, are based either on covering the surface of the fibers or on penetrating the scales and cementing them down. A great drawback in current resin impregnation processes is that the resin solutions or dispersions do not sufficiently penetrate in normal finishing procedure.

The present patent is designed to solve this problem by application of oil solutions or dispersions to achieve better penetration than that effected by application of resin solutions. Oils are characterized as the best penetrating group of substances, capable of entering the smallest openings in the fibers. Drying oils of the polyolefinic type, preferably tri-olefinic chains, that contain conjugated double bonds, e g, tung oil, and oiticica oil, proved to be best suited for this method.

Woolen goods impregnated with one of these oils, either dissolved in gasoline or emulsified soap to a 3% solution or dispersion, are heated in two steps: first, at about 100° C to evaporate the solvent and then, to 150° C for hardening the oil. Accelerators used in standard varnish compositions (such as cobalt linoleate or naphthenate) may be added; the hardening process can be assisted by exposing the goods to X-rays during drying. A further advantage is in the soft hand of the treated material.

The amount of oil (tung oil) applied to the wool fabric varies from 1.5 to 15%. Results of this shrinkproofing method after 10 launderings at 55° C (0.5% soap and 0.25% soda ash solutions) are reported, the shrinkage amounting to 4.8% for 1.5% tung oil and 1.8% for 15% tung oil.

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U S Pat 2,570,566
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All textile goods containing cotton or rayon are easily ignited; pile fabrics are most particularly endangered in this respect. A special test for this type of textiles has therefore been provided by the AATCC.

A well-known flameproofing method hitherto used consists of impregnating with chlorinated resins or chloroparaffins. This finish changes the touch considerably, however, and the pile threads cannot be raised very well after its application. Another process consists of applying antimony solutions that have to be used in high concentrations to avoid premature precipitation of antimony oxide. Here the highly concentrated antimony salt preparations are detrimental to the fiber's strength because of their strongly acid character.

The problem of preparing a flameproofing solution that is stable in the dilute state, that does not attack the cellulosic material, and that renders material flashproof (especially pile fabrics), has been solved by the use of complex titanium-antimony chloride solutions, which can be obtained by first dissolving $TiCl_4$ in water, adding Sb_2O_3 and adjusting the solution with hydrochloric acid at a ratio of one mol HCl for 2 mols of titanylchloride and for each mol of antimony chloride. The concentration of the metal oxides contained in this liquid is given as 200-400 g/l, while the sum of Cl- ions must not be less than 2.5-3 mols above those present in $SbCl_3$. It can be realized that this amount is less than that necessary to form normal chlorides of Ti or Sb, or, in other words, that the solution has basic character. Solutions composed under these conditions are stable for shipment in a concentration of 40% (calculated from the oxide content) and can be diluted to a 30% content before use. After immersion of the goods in this solution at temperatures between 5-75° C —preferably at 25° C but not over 90° C —they are passed through a precipitating bath, e g, an alkaline liquid or a dilute acid. The Ti-Sb- complex is precipitated within the fiber in insoluble form. The fabrics are then washed, and optionally soaped to remove by-products, e g, metal compounds (oxides) that loosely adhere to the fibers. The hand remains soft and napping does not cause any difficulties. The flameproofing property is maintained even after the usual laundering processes.

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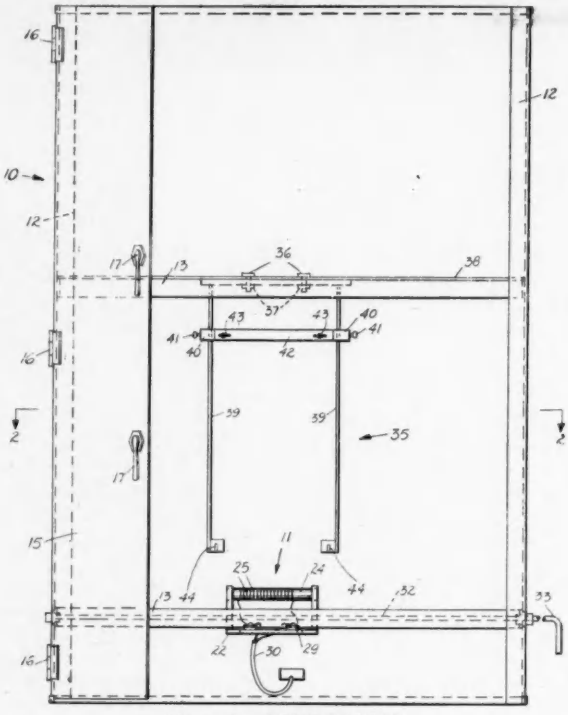

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Example: $TiCl_4$ is dissolved in cold water to a concentration of 210 g TiO_2 and 382 g HCl per liter. Sb_2O_3 is dis-

solved in this liquid to a concentration of 100 g/l. The final solution contains 48% Sb_2O_3 (calculated of the weight of TiO_2) or 26% of the HCl. A clear yellow complex solution results that does not decompose in this concentration while an equivalent $SbCl_3$ solution containing no Ti- ions decomposes quickly and is hydrolyzed. The complex character can be scientifically proven by spectrophotometric comparison of this solution with solutions of the single components.

Among references cited by the Patent Office:

U S Pat 2,427,997 (White/1947): flame resistant impregnations are obtained by using Na_2CO_3 solutions, drying, impregnating with antimony chloride in an organic solvent, passing again through warm soda ash to precipitate the oxide and finally, preparing with chlorinated paraffin (cf *Am Dyestuff Reptr 36,* 720, 1947).

U S Pat 2,416,447 (Du Pont/1947): flameproofing paper by impregnating with Sb_2O_3 (20%) and an organic chlorine-containing polymer, e g, vinylchloride polymer, liberating chlorine at the kindling temperature.

U S Pat 2,395,922 (Timmons/1946): fireproofing by a treatment with a coumarone-indene resin in which antimony oxide and sulfide are incorporated.

U S Pat 2,036,862 (Celanese/1936): a weighting process for acetate of cellulose similar to silk weighting operations that are performed by impregnating with stannic chloride and precipitating the metal compound with triphosphate.

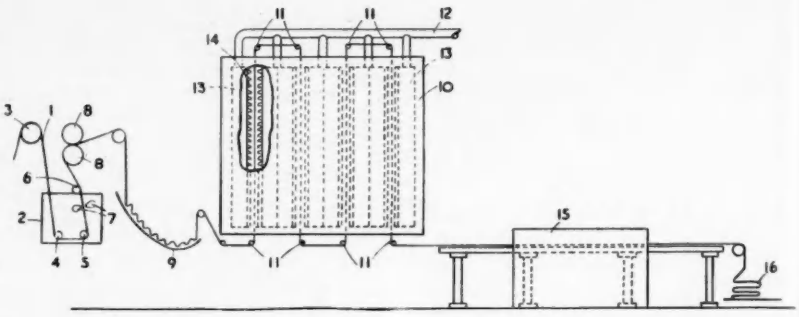
Brit P 9,556 ex 1901 (Dreher): coloring leather by applying pigments and titanium salts.

CONTINUOUS SHRINKING OR PRESETTING TREATMENT OF FABRICS G, 3

U S Pat 2,571,494
(Spooner——Oct 16, 1951)

The purpose of this apparatus is to release strains on warp and filling in a woven fabric during a continuous treatment. It can be used in desizing, scouring, washing, dyeing and drying processes. The accompanying drawing illustrates one unit of this device only but generally a number of similar units will be combined to carry out several operations.

The fabric [1] first passes through a vat [2]. Nozzles [7] which preferably are directed at right angles to the fabric, supply the treating liquid to promote shrinkage and relaxation of the initial strains.



USP 2,571,494

The fabric is then dropped in a scray [9] and run from there to the drying machine [10] over rollers [11], which are driven at differential speed in order to overfeed and to further reduce warp tension. Drying is carried out by directing streams of heated air from pressure chamber [13] through nozzles at an angle to both sides of the fabric. The fabric leaves chamber [10] in a partly dried state and can be remoistened by steam before being finally dried at the tenter [15]. Another modification of this method insures that fabrics are dried completely in chamber [10] and passed thereafter through a separate steamer working in tandem with the drying device prior to tentering. In this event the fabric is fully shrunk and no longer has to be overfed before entering the frame.

The fabric is set on the tenter to an amount compatible with the amount overfed. Therefore, no warp tension is exerted in this phase and the fabrics are dimensionally stable without any mechanical compression, such as in "Sanforizing" or similar processes.

Among other references cited by the Patent Office:

U S Pat 2,415,379 (Du Pont/1947): a pad dyeing process for vat dyeing by pigment padding; carried out by passing through a reducing liquid at temperatures below the reduction point and developing the color in an air-free chamber, the bottom of which contains an alkaline reducing bath (cf *Am Dyestuff Reptr 36,* 419, 1947).

U S Pat 2,390,451 (James Hunter Machine Co/1945): a tenter drier characterized by air-propelling devices at the side of the runs of fabrics (instead of the ends); the blowers are formed to discharge their blast lengthwise of the runs.

U S Pat 2,325,545 (Redman/1943): an apparatus for preshrinking fabrics that are supported throughout the whole operation; the fabrics slide down in folds on this support, being rumpled transversally and longitudinally by mechanically-operated bunchers.

U S Pat 2,275,278 (Andrews/1942): a method of shrinking cloth by drying the wetted cloth in two stages: first, in a straight flattened state (as in a tenter frame), then, in a relaxed state, allowing free shrinking (which generally occurs only on partly-dried material).

Shrinking devices characterized by methods of overfeeding fabrics to a tenter frame have frequently been described in earlier patents (e g, Brit P 443,556—Woodhead or Ger P 649,317-18—Haubold). As a rule the process of drying in a relaxed state was followed heretofore by mechanical compression. In contrast, the present invention suggests that the customary methods be simplified by feeding a completely relaxed, tensionless fabric to the tenter frame.

SILK GAUZE MOUNTING DEVICE D, 4

Brit P 658,353
(McCormick——Oct 10, 1951)

This apparatus consists of a stretching device for screen gauze [A] and an inner frame [B]. The stretching device is fitted with screws [3] holding members [2] on the four sides of the rectangular rigid frame. The members [2]—see Fig 2—contain pairs of grippers [4], formed by projections and recesses [4A] to fix the silk gauze. After sliding these wooden members, which are protected by a U-shaped cover [7] into the channel-formed member [2], they are finally clamped by screws [5] and the material is stretched by tightening screws [3] on the side of the frame [1].

The stretched gauze is glued or stapled to the wooden frame [8], which is fitted into the rigid metal frame [B]. The latter is provided with parallel guide rails, to be slid into the corresponding channels that are fixed on the printing table.

ABSTRACTS

An Oxidizing Type of Fiber Damage in Vat Dyeing and Its Prevention

W Schoenberger, *Melliand Textilber* 32, 631, 1951. Translation in *Dyer* 106, 519, October 19, 1951.

While cerain types of damage which can be caused by vat dyes on the fiber are well known, e g, the accelerated tendering caused by light and by hypochlorite, comparatively little is known about the damage that can occur during the actual dyeing process. That light can affect fibers while they are being dyed with certain vat dyes has been known for some time, but lately another form of damage has become known, one of a purely oxidizing nature.

When certain vat dyes, which are nontenderers otherwise, were dyed on winch becks, it was observed that after some time the fabric started to rot and eventually dropped to pieces. The trouble arose in actual practice and could not be reconciled with the laboratory findings, as the offending dye did not then cause tendering when dyed in the usual manner, although exposed to light. When the conditions of dyeing were altered so that they resembled more closely those of dyeing on a winch beck, i e, repeated exposure of the fabric to air followed by a rereduction in the dyebath similar damage was obtained. It is assumed that during the oxidation-reduction cycle created by this form of dyeing, hydrogen peroxide is formed which, *in statu nascendi*, is particularly destructive to the fiber.

The Indanthrene range was then investigated with respect to dyeing damage, and it was found that there is a certain connection between the constitution of a dye and its dyeing damage properties, although the relationship is not yet clarified. An increase in dyeing temperature favors tendering. Rayon is about twice as susceptible to damage as the natural cellulosic fibers, and it is interesting to note that rayon staple is less susceptible than filament rayon. In the case of the latter, decrease in wet strength may amount to as much as 77 per cent.

Although the degree of damage which may be incurred during vat dyeing under conditions favorable to dyeing damage may be very great, it is now only of theoretical interest, since it is possible by suitable additions to the dyebath to prevent its occurrence. For this purpose a series of aromatic polyoxy compounds are suitable which absorb oxygen or react readily with peroxide. There are marked differences in the effectiveness of various compounds and it was found that empyreumatic oil (Brenzöl, a mixture of various aromatic polyoxy compounds) is most effective. An addition of 0.5 g/l is usually sufficient, but on prolonged dyeing it may be necessary to make further additions. Shade and depth of shade are not appreciably affected.

There seems to be no connection between dyes which are light tenderers and those dyes which cause this type of dyeing damage. Certain metal compounds, though not tendering when added to a blank dyebath, accelerate tendering through dyeing damage when the dye is present. The use of covered winch becks reduces the tendency to tendering, owing to the exclusion of air.—WHC

NEWS

• Cone Heads New Slate of NAFTF Officers

Sidney M Cone, Jr, Cone Finishing Co, Greensboro, N C, was elected President of the National Association of Finishers of Textile Fabrics at the 38th Annual Meeting of the association held on January 15th at the Hotel Statler, New York. He succeeds Arthur G Poor, Standard Bleachery and Printing Co, Carlton Hill, N J, who becomes Chairman of the Executive Committee. H M Burke, Dutchess Bleachery - Lockwood Dutchess, Wappinger Falls, N Y, was elected a Vice-President to succeed Mr Cone. Continuing as Vice-President is Walter R Howell, Bradford Dyeing Association, New York.

Members of the Executive Committee are: G D Harrison, Lewiston Division, Pepperell Manufacturing Co, Lewiston, Maine; Tracy A Adams, U S Finishing Co, Norwich, Conn; William R MacIntyre, Jos Bancroft & Sons Co, Wilmington, Del; George E Sinkinson, Sayles Finishing Plants, Inc, Saylesville, R I; Robert Amory, Springs Mills, Inc, Lancaster, S C; J M Cole, Cold Spring Bleachery, Yardley, Pa; N B Durfee, Lincoln Bleachery and Dye Works, Lonsdale, R I; E R Farrell, Mansfield Bleachery, Mansfield, Mass; W O Forssell, Slatersville Finishing Co, Walpole, Mass, A O Joslin, Rock Hill Printing and Finishing Co, Rock Hill, N C; Lawrence Marx, Jr, Clearwater Finishing Co, Clearwater, S C; Julian Robertson, North Carolina Finishing Co, Salisbury, N C; John A Simmons, Lanett Bleachery and Dye Works, West Point, Ga; John Ward, Bellman Brook Bleachery, Fairview, N J; Richard W Ward, Providence Dyeing, Bleaching and Calendering Co, Providence, R I; William Berry, Riegel Textile Corp, New York; W A Broadfoot, Aspinook Corp, Jewett City, Conn; J K Milliken, Mt Hope Finishing Co, Butner, N C; Clifford B Hayes, Pacific Mills, Lyman, S C; and A L Garfinkel, Lowell Bleachery, Inc, St Louis, Mo.

Miss Alice C Moore, for many years secretary and treasurer of the association, has been granted a two-year leave of absence for reasons of health.

• DCAT Committee Heads Appointed for March Dinner

DCAT Chairman, Charles M Macauley, has appointed the following members to head committees for the forthcoming 26th Annual Dinner to be held on March 6, 1952, at the Waldorf-Astoria:

Dinner Arrangements Committee — Lloyd I Volckening, *Chairman,* William W Huisking, *Vice Chairman; Committee to Maintain Order* — Harold C Green, *Chairman,* J David Hayden and Sydney N Stokes, *Vice Chairmen; Program Committee*—Charles P Walker, Jr, *Chairman,* James G Flanagan, *Vice Chairman; Honor Guest Committee*—Stanley I Clark, *Chairman,* Fred G Singer, *Vice Chairman; Publicity Committee*—Murray Breese, *Chairman,* Russell Boland, *Vice Chairman; Reception Committee*—Robert B Magnus, *Chairman.* Claude A Hanford, *Vice Chairman.*

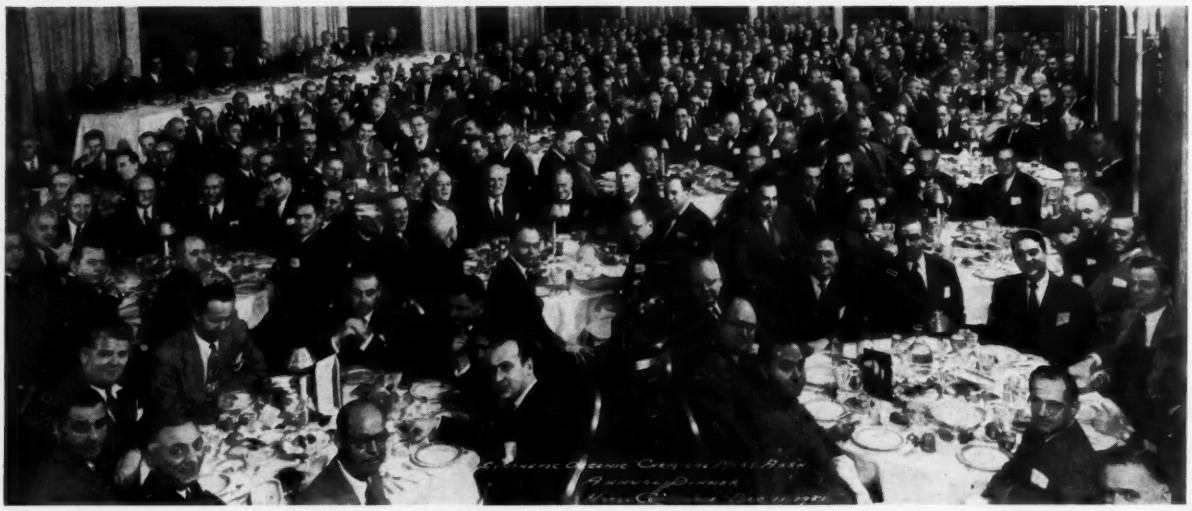


Photo shows the large crowd attracted to the Annual Dinner of the Synthetic Organic Chemical Manufacturers Association, held at the Hotel Commodore, New York, N Y, on Dec 11, 1951.

COMING EVENTS

ACHEMA X
Exhibition Meeting for Chemical Engineering May 18-25, Frankfort/M, Germany.

AMERICAN CHEMICAL SOCIETY
7th National Chemical Exposition Sept 9-13, Chicago Coliseum, Chicago, Ill.

AMERICAN SOCIETY FOR TESTING MATERIALS
Spring Meeting and Committee Week, March 3-7, 1952, Cleveland, Ohio.

Annual Meeting, June 23-27, 1952, New York. N Y. (The biennial Apparatus and Photographic Exhibits will be held in conjunction with this meeting).

1953—Spring Meeting (Hotel Statler, Detroit, Mich.)

Annual Meeting (Chalfonte-Haddon Hall, Atlantic City, N J.)

1954—Spring Meeting (Shoreham Hotel, Washington, D C)

Annual Meeting (Sherman Hotel, Chicago, Ill.)

AMERICAN STANDARDS ASSOCIATION
3rd National Standardization Conference, Sept 8-10, Museum of Science and Industry, Chicago, Ill.

34th Annual Meeting, November 19, Waldorf-Astoria, New York N Y.

BRITISH INDUSTRIES FAIR
May 5-16, London and Birmingham, England.

CANADIAN ASSOCIATION OF TEXTILE COLOURISTS AND CHEMISTS
Annual Meeting (Quebec Section) April 25-26, Mount Royal Hotel, Montreal, Que.

CANADIAN TEXTILE SEMINAR
September, Queens University, Kingston, Ont.

CHICAGO INTERNATIONAL TRADE FAIR
Mar 22-April 6, Navy Pier, Chicago, Ill.

FIBER SOCIETY
Meeting: April 16-17, 1952 (Clemson House, Clemson, S C.)

NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS
41st Knitting Arts Exhibition, April 27-May 1, 1953, Atlantic City Auditorium, Atlantic City, N J.

NATIONAL COTTON COUNCIL
Cotton Research Clinic, Feb 13-15, Pinehurst, N C.

NATIONAL KNITTED OUTERWEAR ASSOCIATION and UNDERWEAR INSTITUTE
Knitting and Allied Crafts Exposition, April 21-25, Grand Central Palace, New York, N Y.

NATIONAL ASSOCIATION OF TEXTILE MACHINERY MANUFACTURERS
Exhibit of American Textile Machinery, April 26-May 1, 1954, Atlantic City Exhibition Hall. Atlantc City, N J.

NEW YORK BOARD OF TRADE
26th Annual Dinner of the Drug, Chemical and Allied Trades: March 6, 1952.

26th Annual Meeting: September 25-28, Pocono Manor Inn, Pocono Manor, Pa.

PHI PSI FRATERNITY
49th Annual Convention, May 1-3, Clemson House, Clemson, S C.

PHILADELPHIA TEXTILE INSTITUTE ALUMNI ASSOCIATION
51st Mid-Winter Banquet, Feb 8, Warwick Hotel, Philadelphia, Pa.

SOCIETE DE CHEMIE INDUSTRIELLE
25th International Congress for Industrial Chemistry, May 18-25, Paris, France.

SOCIETY OF PLASTICS INDUSTRY, INC
5th National Plastics Exposition, Mar 11-14, Convention Hall, Philadelphia, Pa.

TEXTILE INSTITUTE
Annual Conference, June 2-6, Edinburgh, Scotland.

NEW PRODUCTS

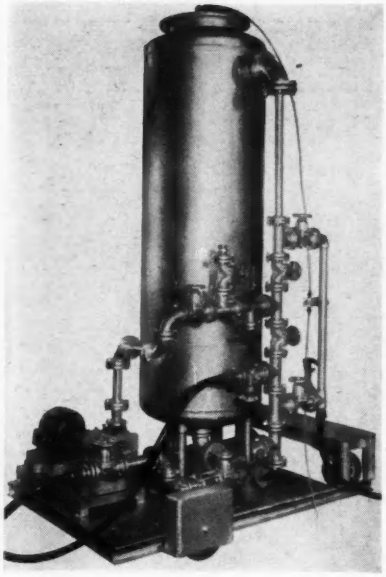
• Dexter Cites Successful Application of New Assistant

Results indicate that the high stability and dispersing properties of Telkanite M in acid media make it highly effective in the pasting up and dispersing of bases when used in ratios of 1-2% on the liquor volume or on a cost basis against other stabilizers, according to the Dexter Chemical Corporation, manufacturers of the new assistant. Successful application of Telkanite M in key plants doing all types of napthol dyeing and printing is cited by Dexter. In all applications, it is stated, Telkanite M has been unaffected by diazotizing and has promoted clear stable solutions of bases for long periods.

Dexter has found that the addition of Telkanite M to the base or salt solution for napthol dyeing of piece goods tends to disperse the unfixed color lake with 1% Telkanite M in the pad liquor satisfactory for this purpose. Used this way, the product is said to promote easier scouring of excess color from the fabric and reduce the tendency to crock.

The tendency of napthol prints to bleed onto white grounds during soaping is also said to be answered by the use of Telkanite M. In this application, the product is added to a salt or base print. A number of plants have reported that in addition to fixing the print, the Telkanite M has promoted removal of the thickener and has reduced mark-off blotches at the nip rolls of the soaper.

Telkanite M is a clear, water soluble oil. Storage properties in the opened barrel are said to be excellent with no jelling or solidification occurring upon long standing.



Illco-Way Portable Chrome Purifier

• Chrome Purifer, Portable Unit

A portable version of its Chrome Purifier has been devised by the Illinois Water Treatment Company, Rockford, Ill for recovering and purifying chromic acid anodizing baths and reclaiming plating and rinse waters.

The Chrome Purifier—newest of Illco-Way developments in ion exchange engineering—is said to eliminate the necessity of discarding chromic acid that is normally replaced with fresh acid to maintain a required pH and acid concentration. Contamination of the acid solution is reportedly kept at a minimum when processed by this method.

In plating, the new purifier permits recovery of contaminated chrome plating baths that must otherwise be discarded, according to the manufacturer. Clear solutions produced by this method are said to reduce current requirements and provide uniform plating.

The unit is available in four standard sizes, each in stationary or portable models.

• "Primene" New Trade Name For Rohm & Hass Alkylamines

In view of the growing interest in their new tertiary-alkyl primary amines and derivatives, Rohm & Haas Company recently assigned trade names to these products. The alkylamines are now known as Primene, and the alkylamine acetates as Primac.

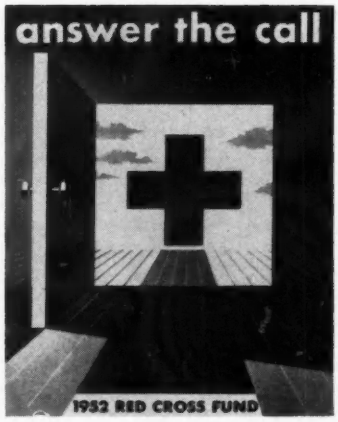
Currently, four amines comprise the Primene series. All are primary amines having a tertiary alkylamine structure.

• Pennsalt Announces New Dry-Cleaning Soap

Flo-Klear, a dry cleaning soap for use with sweetener powders in charged systems, is the latest addition to the family of Pennsylvania Salt Manufacturing Company chemicals for the dry-cleaning industry.

An outstanding feature of the new product, namely, that it flows through the filter with very slight loss, is said to assure improved cleaning performances because a large percentage of Flo-Klear remains in the filtered solvent for removal of heavy soils. At the same time, the sweetener powders are said to remove fatty acids and other soils from the solvent, leaving it clean and clear. Flo-Klear, consequently, avoids the difficulties of high fatty acid build-up and odor.

The new soap, developed at the company's Whitemarsh Research Laboratories, is being manufactured at their Cornwells Heights, Pa, plant. It is packed in 15, 30 and 55-gallon drums.



• Lab-Chron Electric Stop Watch

Laboratory Industries, Inc, 4710 West North Ave, Chicago 39, Ill offers eleven exclusive features in their Lab-Chron electric stop watch, a unit where the synchronous motor and timer are designed to do a specific timing job—counting .1 to 9999.9 seconds, or in the minute model, .01 to 999.99 minutes.

In addition to an unconditional year's guarantee, the manufacturer offers a built-in brake for instantaneous stop, a zero finding reset built into a special counter, "optimum" visibility angle due to case design, high torque synchronous motor, lifetime sealed lubrication, fully-protected start and stop switch with finger ease button, one-finger reset, panel mounting model, 3-wire grounded cord and plug, and general compactness.

Lab-Chron Electric Stopwatch

The counting unit with built-in reset and the synchronous motor function as a single unit. The case is heavy cast aluminum, finished in metalized grey hammerloid, which is baked on. Four rubber feet protect table top and prevent sliding.

Complete price (ready to plug in) is listed as $49.50.

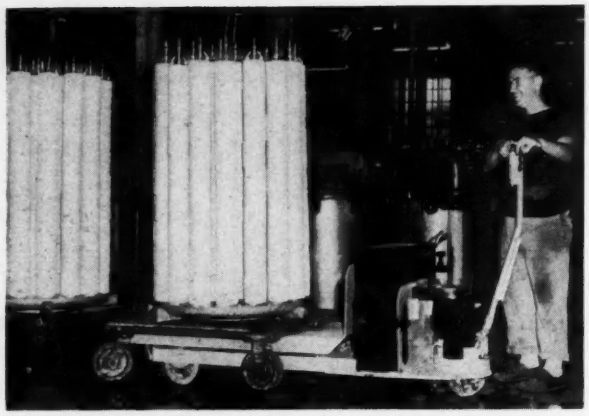
• FDS Soiled Cloth

A new test fabric designed to enable industrial laboratories to determine how clean and bright a particular soap or syndet really gets the family wash has been developed by Foster D Snell, Inc, 29 West 15th Street, New York, under the name FDS Soiled Cloth. The Snell organization, long a pioneer in laboratory studies on detergents, developed the cloth in an effort to meet the need for an artificially-soiled cotton fabric, the soil characteristics of which resemble natural grease, grime and dirt.

The new stable-to-storage fabric, which is said to give results by being washed once, complements PSC Soiled Cotton for multiwash testing and FDS Soiled Wool for light duty detergents. The soil employed consists of a mixture of carbon, saturated fatty acids, saturated oils, and mineral oil.

The proportions of triglycerides, free fatty acids, and unsaponified oils are reportedly set to correspond with average values for naturally soiled fabrics, as determined in published researches. It has been found that these proportions affect not only absolute wash-test readings but also relative values of different detergents.

Tests conducted at Foster D Snell, Inc are said to have indicated that this fabric gives unusually realistic comparative values for different detergents.



Hand-led, powered industrial trucks of the platform type are used in the dye houses of various of the American Thread Company mills in New England and the South, to move dolly-loads of thread to and from dyeing vats, as shown in this photograph. Overhead hoist is about to remove this dye-carrier of packages of yarn and immerse it in a dye vat.

• Monsanto Rewetting Agents Attract Interest in Trade

Of the 29 new Monsanto Chemical Company chemicals and plastics on display at the recent Exposition of Chemical Industries in New York, Sterox TU and Sterox TX, two new rewetting agents, were of particular interest to the textile industry. The products are said to combine good detergency, wetting action and low foaming.

Both are nonionic surface-active-agents compatible with other types and are supplied in a highly concentrated form without builder salts. They are also expected to find use as emulsifiers, scouring agents for degreasing woolen skeins and in the preparation of sanitizing compounds. Sterox TX is said to be especially suitable for preparing liquid cleaning compounds.

• Heyden Offers Four New Organic Chemicals in Research Quantities

Heyden Chemical Corporation has developed four new organic chemicals which will be made available in experimental quantities for development work. These include 5-Chlorosalicylic acid, suggested by Heyden as a highly efficient "carrier" in the dyeing of Dacron, Orlon, Dynel, nylon, and other new synthetic fibers. The product is also expected to be of special value in dyeing Dacron polyester fiber, which requires special handling to be dyed in level deep shades that are resistant to fading. The present techniques for the piece-dyeing of Dacron call for the addition to the dye bath of an auxiliary chemical as a carrier, such as salicylic or benzoic acid.

Although 5-Chlorosalicylic acid would be a more expensive material even when produced commercially than salicylic or benzoic acid, it is reported effective in lower concentrations and may be preferred for some specialty uses in this field.

Heyden also is offering Meta Hydroxybenzoic Acid in experimental quantities for development work, a product suggested for use as an intermediate in the preparation of fine chemicals. Methylene-di-o-Cresotinic Acid, a dibasic acid, also is being offered experimentally by Heyden. Uses suggested for this new product include applications in the production of specialty dyestuffs and resins for surface coatings and printing inks.

Dipentek Diformal is the fourth new compound being offered by Heyden in research quantities. It is suggested as a resin ingredient.

• Acrylic Copolymer Emulsions

Polyco 434 and Polyco 435, new stable copolymer dispersions of higher acrylic esters, are reported to be yielding flexible, water-clear, nonoxidizable films with moderate to considerable tack and excellent aging characteristics when dry.

These emulsions, manufactured by American Polymer Corporation, Peabody, Mass, are said to contain no added plasticizers and thus are free of the disadvantages of embrittlement and variable film properties due to plasticizer migration or volatilization. It is reported that continuous films can be formed at room temperature, the properties of which are enhanced by drying or heat treating at 60-80°C.

Laminex Molded Fiberglas Trucks

• Laminex Textile Trucks

Several special features are embodied in the new line of molded Fiberglas trucks recently introduced by the Laminex Corporation, Fall River, Mass.

Light-weight and easily cleaned, each truck is molded complete in one piece, thereby eliminating the need for rivets, bolts, nuts, screws or other fastening devices on which yarns and fabrics are apt to snag. A rounded reinforcing top rail is built in, as are vertical ribs to supply extra strength. The result is said to be a strong, smooth interior and exterior finish with controlled wall thicknesses.

The trucks are reportedly nonconductive to static electricity, and it is stated that they can withstand all chemicals commonly used in such processing as dyeing, finishing, or yarn conditioning.

Propelled on casters, the trucks are provided in a range of sizes from a small yarn model to the large dyehouse type capable of handling 3500 lbs of wet goods.

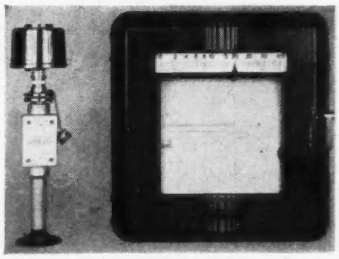
• Steelcote Develops New Surface Coating

The Steelcote Manufacturing Company, St Louis, Mo, announces a new surface coating, which reportedly will do many of the tough maintenance jobs not now satisfactorily performed by pigmented paints and enamels.

The product, Steelcote Stainless Steel Coating, is designed to protect all types of metal surfaces from rust, corrosion and other types of deterioration caused by salt air and water, industrial atmospheres, alkalis, oils, greases, most strong acids, heat, cold and sunlight.

Applied by brush or spray gun, the film is said to be noninflammable, odorless and tasteless when dry. It reportedly will take fungus treatments. Drying to handle takes from 30 to 60 minutes; for regular use, 3 to 4 hours.

Packed in 1 and 5 gallon containers, the coating is said to cost approximately 4c per square foot.



• Recording Daylight Illuminometer

Leeds & Northrup Company, 4934 Stenton Ave, Philadelphia 44, Pa, announces a recording daylight illuminometer, consisting of a Speedomax recorder and an illuminometer cell assembly, for recording daylight intensity directly in foot-candles. The cell unit and the recorder are designed to operate together as a calibrated assembly.

The company's electronic-type Speedomax potentiometer recorder is said to be specifically adapted to this application, having an approximately logarithmic scale for maximum detail of record in the zone of principal interest. The cell, for mounting atop a mast or in any dominant location, is a refined version of a U S Weather Bureau design, tested in field service. Using a barrier-layer photocell, the assembly is designed for collecting total illumination of sun and sky, and for filtration to match the photocell spectral response to the mean visibility curve of the human eye.

The cell may be several hundred feet distant from the recorder, or for remote measuring over long distances, transmitting and receiving recorders can be supplied.

• Emery A-805-R Stearanilide

A hard, odorless, waxy solid, Emery A-805-R Stearanilide, has been made available in experimental quantities as a new development product by Emery Industries, Inc, Dept 5, Carew Tower, Cincinnati 2, Ohio.

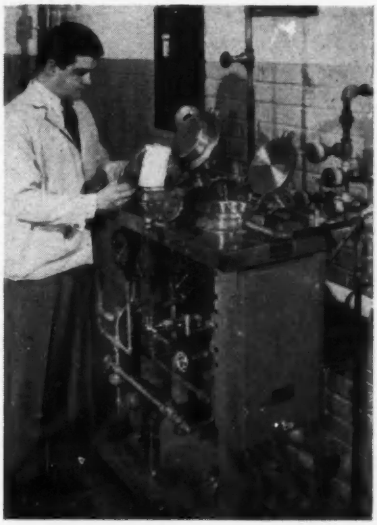
Typical characteristics include: acid value, 3.0; melting point, 81°C; hardness (Shore Durometer B), 65; flash point, 480°F; fire point, 535°F; color, solid, light tan. At higher temperatures the product's solubility in solvents is said to increase, and in cooling, its ability to hold large quantities of solvent reportedly results in the formation of a gel.

Because of its wax-like character and compatibility with waxes, Stearanilide shows promise as a wax or wax extender (e g, for textile auxiliaries).

• Avisco Experiments With High-Temperature Dyeing

The possibilities in dyeing Acrilan, rayon and acetate at elevated temperatures has prompted the American Viscose Corporation to install a Smith-Drum high-temperature, high-pressure dyeing machine in its Textile Research Department, Marcus Hook, Pa.

Although it is generally accepted that these fibers can be dyed at ordinary pressures and temperatures below the boil, it is expected that the increased speed of diffusion obtained at 220 to 250°F will shorten the dyeing time considerably. Increased thickness of metal in this new machine reportedly permits operation up to 300°F in a closed system with little or no air present. This absence of air is said to permit the use of vat and other temperature-sensitive dyes at temperatures far above those at which they are adversely affected in air. The machine will dye 2 lbs of yarn in wound package form, in cakes, or as staple.



Smith-Drum High-Temperature, High-Pressure Dyeing Machine

• Fischer Offers Precise Control of Water Bath Temperatures

Precise control of water bath temperatures "in an order never before obtained" is claimed possible with the Fisher Isotemp Bath (Fisher Scientific Co, 717 Forbes St, Pittsburgh, Pa). The constancy of bath temperature is reported as ±0.005°C over its entire range of about —5 to 107°C, though actual tests are said to have produced variations as small as 0.002° over a long period of time.

A complete design change from conventional water bath employs an electronic circuit to control a 400-watt and an 800-watt heater. Also, the heating elements, stirrer and controls are contained in a central column with all connections made through the bottom of the 15x15" Pyrex brand glass bath, thus providing an unobstructed top surface for inserting samples.

Stirring is effected by a 1150 rpm motor and propellers so that the entire 10 gallon water (or light mineral oil) content is constantly in motion.

The new bath is housed in a cube-shaped case with an opening in front for observation of samples under test. The back portion and bottom of the bath have been ground, and are illuminated from below with fluorescent lamps for maximum visibility. Samples, inserted through any of eight openings in the rotatable cover, may be turned to the front of the bath for observation. An accessory cooling coil may be obtained which permits bath temperatures below that of the room.

• Cyanamid Offering 3 New Surface-Active Agents in Trial Lots

Three new esters of sodium sulfosuccinic acid are now being offered in trial-lot quantities by the American Cyanamid Company. These surface active agents are homologues of bis (2-ethylhexy) sodium sulfosuccinate (Aerosol OT) in which the 2-ethylhexy group is replaced by higher molecular weight groups as follows:

Surface Active Agent BO—Bis (2-butyl-octyl) sodium sulfosuccinate.

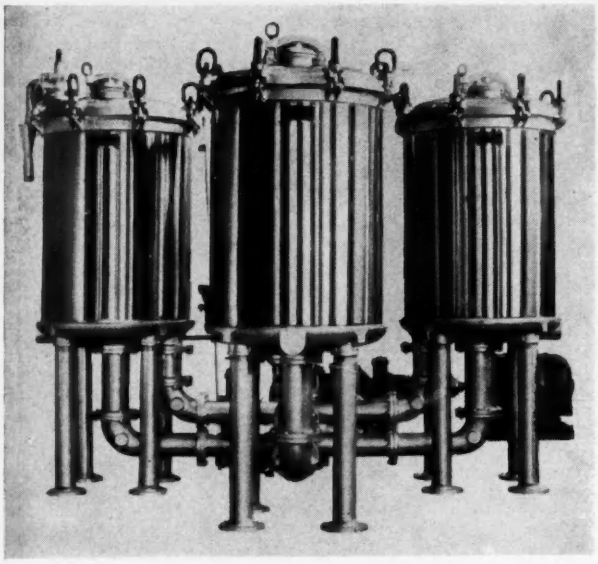
Surface Active Agent TR—Bis (tridecyl) sodium sulfosuccinate.

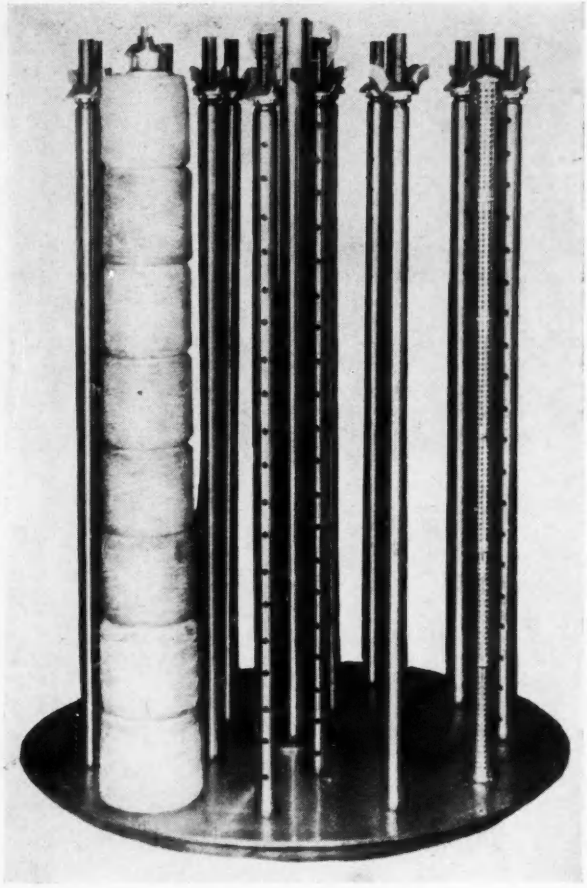
Surface Active Agent BPE—Bis (2-p-tert-butylphenoxyethyl) sodium sulfosuccinate.

All three agents are said to have low solubility in water and high solubility in organic compounds. They are recommended by Cyanamid for producing stable oil-in-water emulsions and for dispersing solids in organic or aqueous media.

Agents BO and TR are reported excellent for forming printing ink and pigment dispersions and it is suggested by the manufacturer that they be tried in other applications where solid-in-oil dispersions are of interest. Agent BO is said to be effective as a textile softener at low concentrations.

Agent BPE is claimed a good wetting-out agent in textile processing and may be effective for increasing the absorbency of various paper products. It is also reported to be an effective wetting agent at elevated temperatures.





(Photos by the Carpenter Steel Co, Alloy Tube Division, Union, N J)

Package dyeing machine (above) made by Gaston County Dyeing Machine Co, Stanley, N C, features Carpenter stainless steel perforated dye tubes (right) for long wear and resistance to corrosion. These fully-automatic machines are made in single or multiple kier setups from 1-2,000 lb units.

• Improved Mounting Medium For Microscope Slides

Those concerned with microscope work will be interested in an improved slide-mounting and clearing medium developed by Dr J P Hall of Manchester University, England. Formula and method of preparation are as follows:

Polyvinyl alcohol, high viscosity	4.00 gm
Glycerine	15.00 cc
Acetone, 70 per cent	14.00 cc
Lactic acid	15.00 cc
Water	30.00 cc
Thymol	0.05 gm

Add the acetone to the polyvinyl alcohol in a dry, glass-stoppered bottle and shake well. The glycerine and lactic acid are mixed with 15 cc of water and added with constant shaking. After standing for ten minutes, the rest of the water is added, then the thymol, and after further shaking, the bottle is warmed on a water bath at about 70°C until all the particles of resin have dissolved. This takes from one-half to one hour, but if the polyvinyl alcohol is first passed through a No 60 sieve, the time can be reduced to about 15 minutes, it is claimed.

Under these conditions, the resin reportedly does not clump, and the resulting mixture is said to be a translucent, viscous, homogeneous liquid. When used to mount specimens on glass slides, the medium is claimed to be firm enough to handle within an hour of application. Setting time can be reduced to five minutes by warming the mount over a low flame. Further hardening takes place with time, but the mounting does not become brittle, it is learned.

Details of Dr Hall's work may be found in *Pharmaceutical Journal 167,* 65 (1951).

• Commercial Production of Technical Trichlorobenzene Begun

Diamond Alkali Company, Cleveland, O, has announced the starting of commercial production of technical trichlorobenzene at the Houston, Texas plant of its Kolker subsidiary.

The new product finds application as an aid to the manufacture of dye intermediates in addition to enjoying extensive uses in the insecticide field. Other applications include its use as a solvent for fats, oils, waxes and resins, and as a heat-transfer medium.

Among other specifications, the product has a boiling point range of 210-230°C, a specific gravity of 1.463, a freezing point of 8°C and a pH of 6. It is now available in both drum and tank car quantities.

• New Warwick Products

Three new products, a substituted cyclic penetrant (Eumercin HRC), a rotogravure printing color for vinyl film (Suntone White VSI), and a special conversion of a root starch complex for building up the hand of water repellent fabrics, are currently being produced by the Warwick Chemical Company, Division of Sun Chemical Corp, and are now available.

Eumercin HRC is a new addition to the company's Eumercin line and is reported to be effective in caustic soda solutions of approximately 90° Tw. It finds effective application in plissé work.

Suntone White VSI has outstanding hiding power exceeding anything heretofore offered on a per gallon cost basis, according to Warwick.

Setole H-59 is desinged to fill a continuing need for renewable water repellent finishes which build up a fabric. The fabric, after jig dyeing, is batched, then immersed in the necessary concentration of Setole H-59, squeezed and dried before passing through the required concentration of the Impregnole water repellent.

TECHNICAL LITERATURE

Schedule B, Statistical Classification of Domestic and Foregn Commodities Exported from the United States (1952 Edition)

Superintendent of Documents
Government Printing Office
Washington 25, D C
(Also available from local Collectors of Customs and Dep't of Commerce Field Offices)
$3.50 domestic; $4.50 foreign

Schedule B commodity classifications code numbers required on Shipper's Export Declarations are shown in this new edition, which is issued in one loose-leaf volume containing the following:

1. The numerically arranged Classification of Exports with list of individual commodity items under each commodity number (formerly published as Part II, "Numbered Classifications and Articles Included").
2. Alphabetic Index (formerly published as Part I, the "Alphabetic Index"). The Index will indicate opposite each alphabetic listing the page number or numbers of the numerically arranged part of the volume where the item may be located.

The new schedule became effective January 1, rendering obsolete the 1949 edition.

Baker & Adamson Laboratory Reagents and Fine Chemicals

General Chemical Division
Allied Chemical & Dye Corporation
40 Rector Street
New York 6, N Y
Available on request

This 264-page booklet includes material on approximately 1000 products of General Chemical under its Baker & Adamson trade-mark, ranging from small bottle lots of laboratory reagents to carload quantities of fine chemicals for industrial use.

For convenience, a thumb index is provided opposite the table of contents to use for fanning the book to a desired item. The index categories serve to exemplify the scope of the book, being broken down into the following: Offices, Distributing Stations, Ordering, Prices, Product Classifications, Packaging, Labeling, Storage & Handling, Products and Specifications, Organic Chemicals, Filter Paper, Stains & Indicators, Horne's Dry Lead, Mineral Acids and Ammonia, Fine Chemicals, Special Chemicals, Pharmaceutic Chemicals, Fluorine Compounds, Heavy Chemicals and Agricultural Chemicals.

The Quantitative Determination of Copper, Zinc and Mercury in Treated Fibers and Fabrics

Nuodex Products Company, Inc
Elizabeth F, New Jersey
(Distributed by Verne Burnett Associates, 522 Fifth Ave, New York 18, N Y)
Available on request

This special report is designed to assist in the proper determination of needed quantities of copper, zinc and mercury in fungicide-treating of fibers and fabrics. It was originally prepared during World War II to aid manufacturers in setting up control processes as protection against government rejection in insufficiently mildew-proofed fabrics, and has been revised and re-issued in the light of current intensified procurement.

The over-all efficiency of mildew-proofing processes involving fungicides containing metals can be predicted from the amount of metal deposited on the fabric, and since analysis of fabrics is a matter of daily routine for Nuodex, a study was made of a number of such methods to find the simplest, most accurate and easiest to conduct under practical working conditions.

Four simple methods were developed and are included in the report. It is claimed that with them, the amount of copper, zinc, or mercury can readily be determined by chemical analysis under practical conditions in fabrics treated with compounds of these metals.

Effect of Construction on the Laundering Shrinkage of Knitted Woolens

Office of Technical Services
U S Department of Commerce
Washington 25, D C
50c a copy (payable by check or money order to the Treasurer of the United States)

A method of producing knitted woolens with "the least possible shrinkage when washed" is disclosed in this Army Quartermaster and Development Report (PB 104 048).

The Army, always troubled with large replacements of woolen service garments due to shrinkage during washing, turned to the use of shrink-resistant treated yarns and found that was not enough, the use of treated yarns only partly reducing the shrinkage of knitted garments. The Quartermaster Corps then investigated all the factors involved in shrinkage of knitted woolens—the yarn's twist, the type of spinning, amount of shrink resistant treatment, number of plies, and yarn number—and came up with this report.

Erio Fast Brown 5GL

Geigy Company, Inc
89-91 Barclay Street
New York 8, N Y

Geigy describes this homogeneous, level dyeing Acid Brown in Bulletin 30-G, giving dyeing procedure, characteristics and fastness properties and supplementing this information with mounted samples of dyeings.

Applied from a sulfuric acid bath by standard procedures, this new dyestuff is said to be especially suited for producing delicate made mode shades on woolen yarn and piece goods and, therefore, is of particular interest for carpets, rugs, knitting yarns and women's wear. Erio Fast Brown 5GL is also recommended by Geigy for dyeing felt hats because, in addition to excellent light resistance, it dyes level and has good penetrating properties.

Erio Fast Brown 5GL can be used to advantage as the yellow element in combinations calling for yellow, red and blue, the manufacturer states. When combined with the proper selection of dyestuffs, the results are said to be unsurpassed for light fastness.

Abstract of Certain U S Government Specifications for Textiles and Textile Products Requiring Fungicides

Nuodex Products Co, Inc
Elizabeth F, New Jersey

An abstract containing a tabulation of U S Army, Navy, Air Force, Coast Gaurd and Federal specifications for the mildew-resistant treatment of textiles, together with the name and concentration of the applicable Nuodex fungicide(s).

Following the specification lists, Nuodex gives the physical and chemical constants as well as brief descriptions of the company materials mentioned in the abstract.

The abstract is revised every 3 months to include all changes made during the quarter.

• Late Honeywell Literature

New technical literature of the Minneapolis-Honeywell Regulator Company, as reviewed below, may be obtained by referring inquiries to the Company at Station 40, Wayne and Windrim Avenues, Philadelphia 44, Pa.

THERMOMETERS

New 4-page specification sheet describes Brown Indicating and Recording Ther-

mometers. Construction and engineering details are included. Specification Sheet 600.

INDICATING AND RECORDING FLUE GAS ANALYZER, AN ACCURATE GUIDE TO EFFICIENT AND ECONOMICAL COMBUSTION

Instrumentation Data Sheet 10.15-3a describes the Davis indicating and recording flue gas analyzer which utilizes a Davis thermal conductivity gas analyzer in combination with a Brown ElectroniK recorder. The combined apparatus provides continuous recorded combustion analysis. The data sheet describes the equipment and explains how it is used for combustion control analysis and describes the operation and construction of the apparatus. Photographic illustrations and schematic diagrams facilitate the explanation of the device and are included in the four-page data sheet.

RADIAMATIC PYROMETERS COMPENSATED RADIATION DETECTORS

The Brown line of *Radiamatic* pyrometers is completely described in this new 28-page catalog 9300. Included are sections on operation, theory, constructional features, engineering specifications, accessories, and typical applications. Many photographs and line drawings supplement the written information.

PROPER VALVE LUBRICATION

The article reprint entitled "Proper Valve Lubrication . . . A Prerequisite to Good Control" discusses the importance of proper valve lubrication in keeping valves operating at peak efficiency.

Also covered are the function, proper selection, methods of application and the various types of lubricants in general use.

INSTRUMENTATION FOR SLASHER ROOM PROCESSES

Bulletin 9306 discusses practically all slasher room instrumentation. The benefits of measurement and control are discussed without excessive treatment of system technicalities.

COMPOSITE CATALOG

Catalog No. 5000, consisting of 28-pages, describes the principal instruments, control devices and related components manufactured by the Industrial Division of Minneapolis-Honeywell Regulator Company.

Specifications of approximately 100 measuring and control instruments, and valves are outlined. Included are several new designs including the Differential Controller and Tel-O-Set Controller Family.

The Mico Fiber Microtome

Mico Instrument Co
80 Trowbridge Street
Cambridge, Massachusetts

Characteristics, prices and illustrative material are included in this folder on the Mico Fiber Microtome, which is designed to make possible rapid preparation of very thin sections for commercial analysis, e g, to identify fiber content in mixtures of yarn.

Photomicrographs of commercial fibers (X 400) may be prepared on the instrument.

Catalog Section S-5005

National Carbon Company
Union Carbide and Carbon Corp
30 East 42nd Street
New York 17, N Y
Available on request

This 20-page catalog section describes and illustrates "National" carbon and graphite and "Karbate" Impervious carbon and graphite products now available from National Carbon Company in grades from porous to impervious. Information is given on sizes and physical characteristics of each product, in addition to many useful tables, such as typical physical properties of carbon and graphite products, corrosion resistance of "Karbate" products, performance curves of "Karbate" pumps, permeability of porous carbon and graphite, etc.

The principal features claimed for carbon and graphite, whether porous, regular or impervious, include resistance to practically all corrosive chemicals, high heat transfer of graphite products and low heat transfer of carbon products, ease of machining and fabrication, resistance to severe thermal shock, low thermal expansion, strength maintained with no deformation at high temperatures and good electrical conductivity.

Builders Mechanically-Operated Filter Gauges

Builders-Providence, Inc
345 Harris Avenue
Providence 1, R I

The various models of filter gauges manufactured by Builders-Providence are described in this new literature (Bull No 450-H10), along with brief material relating to the operation principle used in them.

The Diaphragm Pendulum Unit, which is usually an integral part necessary in the operation of most filter gauges, is thoroughly discussed, as are the gauges for recording water level and other special units.

G E Measuring Equipment for Laboratory and Production Testing

General Electric Company
Schenectady 5, New York

All of the General Electric Company's testing and measuring equipment for laboratory and production line use is summarized in this 80-page booklet.

To be used primarily as a reference to the apparatus available for the complex measurements to be made in industry, the new catalog (GEC-1016) contains more than 150 photographs and diagrams and describes the uses, features, specifications and prices of more than 130 G-E testing and measuring equipments. The new catalog also contains publication references to G-E bulletins that describe each device in more detail.

Dollar Savings Through Standards

American Standards Association
70 East 45th Street
New York 17, New York
$1.00 per copy

Specific savings and production benefits directly attributed to standardization in American industry are cited in this 32-page presentation of 140 documented case history studies. The book is a printing of a report called "Survey to Obtain Data to Show Savings Derived from the Use of Standards by American Industry". It was prepared for the Economic Cooperation Administration, by the American Standards Association, to encourage European manufacturers to adopt U S production methods in order to speed military preparedness and to strengthen economic self-independence.

Reilly Protective Coatings for Metal Surfaces Exposed to Corrosion, Tuberculation and Incrustation

Reilly Tar and Chemical Corp
1615 Merchants Bank Building
Indianapolis, Indiana
Available on request

This 24-page booklet, covering hot application enamels, primers and coupling compounds, cold application enamels and bituminous paints, contains (in outline form) information on properties, uses, containers, performance tests and application procedure for coatings; handling, storage and inspection of protected surfaces; plus field notes on application, which include quantities of enamel needed for various pipe sizes.

Photographs of pipe and other surfaces which have been protected with Reilly Enamels illustrate the booklet.